GROWTH OF THE ALBERTA PETROLEUM PRODUCING INDUSTRY

1947 - 1952

AN INCOME-EXPENDITURE ANALYSIS

by

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The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Trends of the Alberta Petroleum Refining Industry, 1947-1957 -- An Inter-Expenditure Analysis" submitted by George David Quirk, in partial fulfilment of the requirements for the degree of Master of Arts.

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ABSTRACT

Growth of the Alberta Petroleum Producing Industry, 1947 - 1952, An Income-Expenditure Analysis

This thesis is an analysis of the sources of funds and cash expenditures of the Alberta petroleum producing industry for the years 1947 to 1952. Expenditures and sources of funds have been allocated to geographical areas including Alberta, the rest of Canada, and foreign countries. Expenditures have also been analysed by technological function and sources of funds by type of investment.

The method employed in estimating expenditures involves application of unit cost estimates to available statistics of activity in physical terms. The geographic analysis of expenditures is based upon content of the unit cost estimates. An estimate of working capital requirements, based on expenditures, has been used to derive total funds required. Estimates were then made of the way in which these were supplied, on the basis of published financial statistics for publicly-owned companies and a variety of other sources.

The principal conclusions relate to geographic expenditure patterns and sources of funds. It is estimated that the proportion of expenditures remaining in Alberta rose from 48.5 percent in 1947 to 61.8 percent in 1952. Expenditures in other parts of Canada dropped from 19.5 percent in 1947 to 13.0 percent in 1952, and expenditures in foreign countries also dropped from 32.0 percent in 1947 to 25.2 percent in 1952.

With regard to sources of funds, these estimates indicate that Canadian sources supplied, in the first instance, over 50% of the required capital funds for the industry in every year studied except 1948. It is suggested, however, that majority ownership has passed outside Canada through secondary transactions.

ABSTRACT (continued)

Additional conclusions relate to the level of producing costs in Alberta and elsewhere, and to the primary income effect generated within Alberta and within Canada by the growth of this industry. It is estimated that within Alberta, primary income generated by the petroleum producing industry rose from 1.7 percent of personal income in 1947 to 17.8 percent in 1952.

THE UNIVERSITY OF ALBERTA

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Sole responsibility for all views expressed, and for any error, is that of the author.

(George David Quirin)

March, 1958.

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ABBREVIATIONS USED

A.A.P.G.	American Association of Petroleum Geologists
A.P.I.	American Petroleum Institute
bbls.	Barrels (35 Imperial gallons)
C.I.M.M.	Canadian Institute of Mining and Metallurgy
C.P.A.	Canadian Petroleum Association
D.B.S.	Dominion Bureau of Statistics
Mcf.	Thousand(s) cubic feet
P.B.S.	Provincial Bureau of Statistics (Alberta)
G.N.E.	Gross National Expenditure
G.N.P.	Gross National Product

CHAPTER 1

INTRODUCTION

An outstanding feature of the postwar Alberta economy has been the growth of the crude petroleum and natural gas producing industry. The full impact of this growth on the economy has yet to be analyzed. However, it raised the value of Alberta's mineral production threefold from 1946 to 1952, from $60 million to $197 million. While this growth has been spectacular, the basically agricultural character of the Alberta economy is indicated by a comparison of production statistics. Relative growth of the two industries is shown in Table 1.

TABLE 1

Gross Value of Production in Agriculture and the Oil and Gas Industry
Alberta: 1946-52(1)
(thousands of dollars)

	Agriculture	Oil and Gas
1946	282,187	21,532
1948	452,350	43,452
1950	363,458	85,146
1952	506,660	145,774
Percentage Increase 1946-52	80%	578%

Value of production statistics do not give the entire picture, however, since the oil and gas producing industry is in a substantial cash deficit position at the present time, and, during the period under review, expenditures have exceeded the value of production in any given year.

(1) Dominion Bureau of Statistics, Canada Year Book, various issues. A change in the method of valuing natural gas production in 1949 and subsequent years probably results in overstating the 1946 and 1948 figures by some $6,000,000 per year.

CHAPTER I

INTRODUCTION

An outstanding feature of the postwar Alberta economy has been the growth of the crude petroleum and natural gas producing industry. The full impact of this growth on the economy has yet to be analyzed. However, it raised the value of Alberta's mineral production threefold from 1946 to 1952, from $50 million to $147 million. While this growth has been spectacular, the basically agricultural character of the Alberta economy is indicated by a comparison of production statistics. Relative growth of the two industries is shown in Table I.

TABLE I

Gross Value of Production in Agriculture and the Oil and Gas Industry
Alberta: 1946-52(1)
(thousands of dollars)

	Agriculture	Oil and Gas
1946	385,187	31,832
1948	455,330	63,482
1950	383,458	85,146
1952	506,000	145,774
Percentage increase 1946-52	80%	378%

Value of production statistics do not give the entire picture, however, since the oil and gas producing industry is in a substantial cash deficit position at the present time, and, during the period under review, expenditures have exceeded the value of production in any given year.

(1) Dominion Bureau of Statistics, Canada Year Book, various issues. A change in the method of valuing natural gas production in 1951 and subsequent years probably results in overstating the 1952 and 1953 figures by some $2,000,000 per year.

Several estimates of expenditures by the industry have been published. These are listed in Table 2.

TABLE 2

Published Estimates of Expenditures by the Alberta Petroleum Producing Industry: 1947-52

(millions of dollars)

Authority	Item	1947	1948	1949	1950	1951	1952
Dingle, W.B. (2)	Explor.	15	30	60	99	134	N.A.
	Devel.	15	20	65	82	72	N.A.
	Total	30	50	125	181	206	
Provincial Bureau of Statistics (3)	Administration					25.6	44.6
	Exploration					67.9	95.4
	Drilling					76.3	101.2
	Operating Exp.					23.3	32.7
	Pipelines					22.3	36.4
	Other					3.2	4.6
	Total					218.7	314.9
Dominion Bureau of Statistics (4)	Total					200.0	300.0
Alberta Dept. of Mines & Minerals (5)	Total	25	50	100	150	200	250
Imperial Oil Limited (6)	Total		77		194	326	394

Estimates of this nature, of course, fail to account for the whole effect on the provincial economy, in that they do not show the extent of induced in-

(2) Dingle, W.B., Significant Developments in the Canadian Oil and Gas Industry, CIMM Bulletin, June 1952, p.340. Figures are for Western Canada but nearly all expenditures were in Alberta.

(3) Employment Statistics and Expenditures of Firms Engaged in the Development of Alberta Oil and Gas Resources, Edmonton, 1954.

(4) Hume, G.S., Canadian Crude Petroleum Situation, Canada Year Book, 1952-53, p.526; 1954, p.540.

(5) Alberta Oil Picture, 1947-54, Edmonton 1955.

(6) Facts and Figures about Canadian Oil, Toronto, 1955. Totals are for Western Canada.

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TABLE 2

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Authority	Item	1947	1948	1949	1950	1951	1952
Dingle, W.B. (2)	Exploration	15	30	50	99	124	N.A.
	Travel	15	20	35	82	72	N.A.
	Total	30	50	85	181	196	
Provincial Bureau of Statistics (3)	Administration					25.6	44.8
	Production					97.9	85.4
	Drilling					76.3	101.2
	Operating Exp.					39.3	39.7
	Pipelines					34.3	36.4
	Other					1.2	3.5
	Total					218.7	316.9
Dominion Bureau of Statistics (4)	Total					200.0	200.0
Alberta Dept. of Mines & Minerals (5)	Total	15	30	100	120	200	250
Imperial Oil Limited (6)	Total		15		164	220	384

Estimates of this nature, of course, fail to account for the whole effect on the provincial economy, in that they do not show the extent of induced in-

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(2) Dingle, W.B., Significant Developments in the Canadian Oil and Gas Industry, CIMM Bulletin, June 1952, p.340. Figures are for Western Canadian Basin. Nearly all expenditures were in Alberta.

(3) Employment Statistics and Expenditures of Firms Engaged in the Development of Alberta Oil and Gas Resources, Edmonton, 1954.

(4) Hume, G.S., Canadian Crude Petroleum Situation, Canada Year Book, 1952-53, p.396, 1954, p.310.

(5) Alberta Oil Picture, 1947-54, Edmonton 1955.

(6) Facts and Figures about Canadian Oil, Toronto, 1955. Totals are for Western Canada.

vestment in housing and in other industries which has been brought about by the expansion of the producing industry. Such an estimate would require an exhaustive examination of the province's "National Income" and its composition, much of the background for which is lacking.

One of the items needed as background data for such a study is a reliable series of estimates of the direct expenditures of the petroleum producing industry and the pattern of these expenditures. The estimates listed in Table 2 fall short of requirements in several respects, although they are more or less adequate as a measure of the collective effort of the industry.

The first defect of the estimates is that they are incomplete. From the author's personal acquaintance with the data that went into some of the estimates, breakdowns of some of the others as published, and comparisons with the remaining estimates, it appears that none of the estimates includes any provision for cash disbursements of the type referred to as "financial" in this study, including such items as Federal Income Taxes, interest and dividend payments, debt retirements, etc. The magnitude of this omission will be noted later.

Another major drawback in the use of the published estimates as a yardstick for determining the effect of the expansion of this particular industry on the provincial economy, is their failure to differentiate between payments made to owners of the factors of production residing in Alberta and those residing elsewhere. Obviously, only the dollars paid to residents of the province have added to its wealth.

Even as an index of the industry's efforts in finding and developing oil and gas, the estimates are not as useful as one might wish. Except for the Provincial Bureau of Statistics' estimates, component items lose their

research in housing and in other industries which has been brought about by the expansion of the producing industry. Such an estimate would require an exhaustive examination of the province's "natural income" and its exploitation, which is the background for which is lacking.

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Even as an index of the industry's effect on income and development, not well. The estimates [illegible]

significance by being buried in aggregates so all-inclusive as to be virtually meaningless. The provincial Bureau's figures cover too short a period, and for the early years at least, their precision is more apparent than real, for close examination of the figures reveals a number of inconsistencies which are probably due to the use of loose definitions in the questionnaire.

This study is an attempt to supply the required data in a form which makes it more useable for any of the above purposes. It covers all types of expenditures, including "financial" payments as mentioned above, and breaks these down functionally and geographically. The functional analysis provides a yardstick of the industry's efforts and affords some interesting comparisons with expenditure patterns in the United States. The geographical analysis is of more interest to the economist interested in Alberta's economic development. This breakdown divides expenditures into those paid to residents of Alberta, the rest of Canada, and foreign countries. Additional data presented cover the geographical sources of the funds spent by the industry.

It should be noted that the estimates presented in this study include only the petroleum and natural gas producing industry. For the sake of simplicity, "petroleum" will be used, in the rest of this study, to denote both crude oil and natural gas, while the terms "crude oil", "oil", "natural gas", and "gas" refer only to the specified substance. None of the above estimates includes expenditures made on pipelines or refineries. Industry practise, which is followed by most writers discussing the industry and in this study, is to consider the petroleum industry as being composed of four branches, as follows:

1. Producing includes that part of the flow of petroleum from its natural underground reservoirs into the consumer's gas tank or furnace which takes place prior to the sale of petroleum in the field to a

significance by using series in aggregate so ill-behaved as to be virtually meaningless. The econometrical business cycle figures cover too short a period, say for six, sixty years at least, that one should be more suspicious than real, for these cross-section of the figures reveals a number of inconsistencies which are probably due to the use of inner deductions in the econometrics.

This study is an attempt to supply the required area in a form which makes it more usable for any of the above purposes. It covers all types of economic data, including "financial" processes as mentioned above, and breaks them down functionally and geographically. The functional analysis provides a prediction of the industry's growth as well as some interesting comparisons with economies are done in the United States. The geographical analysis is of more interest to the economist interested in Alberta's economic development. This breakdown divides expenditures into those paid to residents of Alberta, the rest of Canada, and foreign countries. Additional data presented cover the geographical sources of the funds taken by the industry.

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1. [illegible] [illegible] part of the [illegible] production type in natural [illegible]

gathering system or pipeline. In other words, it deals with the finding of new supplies of petroleum and their removal from the ground.

2. Manufacturing involves the refining of crude petroleum into finished products.

3. Marketing includes those steps in the chain by which finished products are distributed to consumers.

4. Transportation involves the transmission of crude from the field to the refinery and products from the refinery to market outlets. The oil industry differs from most others in that it uses highly specialized transportation facilities which have no alternative uses, and it has become customary to treat these as part of the petroleum industry.

In this study, gas conservation plants and their related gathering systems are considered as part of the producing portion of the industry rather than as manufacturing operations. Under existing conservation regulations, oil cannot be produced without conservation of gas, if the Oil and Gas Conservation Board (7) deems it desirable and so orders. This being the case, such plants must be regarded as producing facilities. This treatment differs from that of the Provincial Bureau of Statistics, but is in accord with the reasoning of the Department of National Revenue.

The estimates presented here are based on available statistics on costs and physical activity. In some cases the data are rather sketchy and the estimates are quite conjectural. While it is believed that they are as accurate as most of the others which have been published, their justification

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(7) Prior to 1957, the Petroleum and Natural Gas Conservation Board.

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II.

In the chart, the conservation plants are their refining capacities, and are marked with a part of the producing portion of the industry which is [illegible] operations. Under existing conservation legislation, [illegible] cannot be produced without a corresponding conservation of gas. [illegible] tion figure (1) shows it graphically and in detail. This being the case, such plants must be regarded as producing facilities. This provisional [illegible] ment of the Petroleum Bureau of Statistics, and is in harmony with the [illegible] ing of the Department of National Revenue.

The statistics presented here are based on available statistics [illegible] and [illegible] Statistics. In some cases the data [illegible] by the Bureau of Statistics are quite conjectural. While it is believed that they are as accurate as most of the other [illegible] have to obtain, their [illegible]

(1) [illegible] Bureau of Statistics and the Petroleum Bureau.

lies in their completeness and in the analyses presented rather than in superior accuracy. Details of the calculation of estimates from statistics of industry activity are shown in the appendices. Some of the figures have been taken directly from published sources.

For purposes of this analysis, we have tried to estimate flows of cash between five sectors, as follows:

I. Oil producing companies operating within Alberta

II. "Service companies" operating within Alberta

III. The rest of Alberta

IV. The rest of Canada

V. Foreign countries.

Oil producing companies operating within Alberta include many companies which also operate in other provinces and the producing departments of some vertically integrated companies which carry on refining and marketing operations in Alberta and the rest of Canada. None of these companies publishes accounts in sufficiently detailed form to segregate expenditures by area or function. One virtue of the estimating procedure used is that we are able to get behind the published figures and see approximately what expenditures were in Alberta alone. In cases of this kind, we have assumed, in effect, that Alberta producing operations were carried on by separate companies.

"Service companies" are those companies which supply contract services such as contract drilling, coring, drillstem testing, directional drilling assistance, geophysical surveying, electric logging, cementing, technical consulting and a host of others to the oil producing companies. Some producing companies supply these services to themselves through company-owned drilling rigs or seismic equipment. For convenience in exposition,

we have assumed that all drilling and geophysical work was done by separate companies. Such expenditures are included in the second Sector. Similarly, some service companies, particularly drilling contractors, have more or less extensive producing operations. These operations are included in the first Sector. Thus, some of the cash flows between oil companies and service companies really represent intra-company flows.

Cash inflows from the sale of crude also in many cases represent intra-company transactions. It is felt that this approach is essential to isolate the impact of the expansion of the producing portion of the industry.

Of the five Sectors listed, only the first two have any responsibility for expenditures within the province. The other sectors have acted as sources of funds, both as purchasers of crude and as investors. All expenditures made by the first two sectors eventually find their way into one of the last three. Only that portion finally coming to rest in the third Sector represents incremental income to Albertans.

Estimates of expenditures were first of all constructed for the first Sector (oil producing companies) on a functional basis. The six functional classifications used were as follows:

1. Exploration expenditures - those costs incurred in the acquisition of mineral rights and looking for petroleum.
2. Development expenditures - the cost of drilling development wells and equipping them and supplying the additional field facilities necessary to produce petroleum.
3. Operating costs - the cost of taking petroleum from wells and operating field facilities.
4. Administrative and overhead costs which cannot be allocated to

either exploration or development.

5. Financial payments - includes income taxes, interest and dividend payments, debt retirement, and other non-operating items.

6. Royalties - these are not usually considered as an expenditure under conventional accounting definitions, since title to the oil or gas is not taken by the producer. In reality, however, they represent a deferred acquisition cost and constitute one of the chief sources of income from the industry accruing to Albertans.

Expenditures under these functional headings are traced as purchases of goods or services from the other Sectors. Purchases from the service companies' Sector are further traced to one of the three final Sectors giving a breakdown of expenditures by geographical area.

Cash receipts have been analyzed in similar fashion. Sale of crude and natural gas to other Sectors accounts for a large part of the cash receipts. The balance is made up of capital invested by individuals or corporations which are included in one of the other three Sectors.

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5. Financial payments - included income taxes, interest and dividend payments, debt retirement, and other non-operating items.

6. Royalties - these are not usually considered as an expenditure under conventional accounting techniques, since only in the oil or gas is not taken by the producer. In reality, however, they represent a deferred acquisition cost and constitute one of the chief sources of income from the industry according to other sets.

Expenditures under these functional headings are treated as purchases of goods or services from the other industries. Therefore from the aspect of companies' Sector are rather "local" in one of the three Sectors giving a breakdown of expenditures by geographical areas.

Cash receipts have been analysed in similar fashion. Sale of crude and natural gas to other Sectors accounts for a large part of the cash receipts. The balance is made up of capital received in debentures or debenture issues which are included in one or the other of the three categories.

CHAPTER 2.

EXPENDITURE ESTIMATES - SECTOR I

As mentioned in Chapter One, expenditure estimates for this sector were prepared on a functional basis. At this point we will outline the composition of the functional estimates and the classifications used, while the details of calculation are described more fully in the appendix to this Chapter.

The functional classifications chosen agree partly with customary accounting practises in the industry, but have ignored the conventional distinctions in the accounting classification of some items between capital expenditures and current expense. While such classifications are useful in many cases, there is such a wide range of practise between different companies that it is impossible to define certain items as capital or expense. In addition, the peculiar problems of the industry, complicated by income tax regulations, have led to accounting treatment of certain classes of expenditures in a manner that makes comparison of the financial statements of oil producers (and of mining companies) to those of ordinary industrial concerns misleading. Accordingly, it was felt desirable to classify expenditures on the basis of their technical purpose or use only.

All expenditures include cash expenditures only and do not provide for depreciation, depletion, or amortization charges. This was done primarily to avoid any double counting, but there is such a wide variety of practises between companies that estimating book charges would be difficult if not impossible. Charges made for income tax purposes do not reflect the useful life of many assets, and are, to that extent, economically unrealistic.

CHAPTER IV

EXPENDITURE RELATIONSHIPS - PART I

All machines in Canada (Use), expenditure, estimates for life series were prepared on a functional basis. At this point we will consider the position of the individual activities and the circumstances and, while the details of calculation are described more fully in the appendix to this Chapter.

The functional classifications chosen agree partly with customary accounting practices in the industry, but have ignored the conventional distinctions in the accounting classifications between capital expenditures and current expense. While such distinctions are useful in many cases, there is such a wide range of circumstances between different companies that it is impossible to determine what is capital or current expense. In addition, the peculiar problems of the industry, complicated by income tax regulations, have led companies to treat certain classes of expenditures in a manner that bears practically no relation to the needs of oil economics (as it implies capitalization of items of current industrial endeavor relationship). Accordingly, it was felt desirable to classify expenditures on the basis of their technical purpose or use only.

All expenditures include cash expenditures only and do not include depreciation, depletion, or accrued charges. This was done primarily to avoid any double counting, but there is much real reason of variations between companies that potentially that depreciation is without it not important. Charges made for income purposes do not reflect the useful life of many assets, [illegible]

All expenditure and revenue figures are expressed in current dollars. As far as can be ascertained, improvements in efficiency have kept real costs down throughout the period, very close to 1947 levels in terms of results. This applies particularly to drilling costs, and while geophysical unit costs have increased, the increase is insignificant if we allow for altered geographical factors as more and more work is done in wilderness areas, and for changed techniques which provide for more detailed interpretation.

Table 3 lists the estimates of functional expenditures for firms in Sector I. The following discussion should help to clarify the content of the individual items.

The first two classes, Exploration Expenditures and Development Expenditures, include the bulk of the cash outlay made during the period. Since most companies make a practise of expensing exploration costs, published figures on capital invested per employee (1), although they indicate the industry to be very capital-intensive, seriously underestimate the capital requirements of the industry.

Exploratory expenditures have been the largest single functional class in Western Canada in the period under review. They are defined here to include those expenditures incurred in looking for oil or gas and in acquiring the right to produce them.

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(1) Pogue, J.E. and Coqueron, F.G. "Financial Analysis of Thirty Oil Companies for 1947", cited in Uren, L.C., "Petroleum Production Engineering" v.3.p.235 (New York, 1950)

All expenditure and revenue figures are expressed in current dollars. As far as can be ascertained, inventory figures for refinery are kept real and down throughout the period, very close to 1947 levels in terms of results. This applies particularly to refinery costs, and while geological and costs have increased, the increase is undoubtedful if we allow for average geological factors as more and more work is done in wildcatting areas, and for changed techniques which provide for more detailed interpretation.

Table 3 lists the estimates of investment expenditures for firms in Sector 1. The following discussion should help to clarify the content of the individual items.

The first two columns, Exploration Expenditures and Development Expenditure, relate to the work of the oil and gas industry during the period. These most comprehensive single estimates of expenditure exploration costs, published figures are capital investment per employee (1), although they indicate the industry's to be very capital-intensive, seriously underestimate the capital requirements of the industry.

Exploratory expenditures have been the largest single institutional claim in Western Canada in the period under review. They are defined here to include those expenditures incurred in looking for oil or gas and in acquiring the right to produce them.

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(1) Fogue, J.E. and Chapman, J.C. "Financial Analysis of Thirty Oil Companies for 1954", cited in Frank, L.C. "Petroleum Production Economics" p.3.p.ish (New York, 1962)

TABLE 3

FUNCTIONAL EXPENDITURE ESTIMATES - SECTOR I
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
EXPLORATION						
Land Acquisition & Retention	1,680	12,271	30,771	39,156	28,931	41,015
Surveys & Supervision	3,365	9,450	21,005	27,955	41,140	46,440
Exploratory Drilling	4,880	8,890	15,710	16,200	24,600	34,400
Total Exploration	9,925	30,611	67,486	83,311	94,701	121,855
DEVELOPMENT						
Development Drilling	7,940	14,140	31,000	46,700	56,200	62,050
Pumping & Lease Equip.	1,352	3,040	7,602	11,347	12,521	15,745
Gas Plants & Equip.	-	-	2,000	2,500	2,000	2,750
Other	715	1,195	2,300	2,379	2,460	2,750
Total Development	10,007	18,375	42,902	62,926	73,181	83,295
OPERATING						
Lease & Well Operating	2,112	3,477	6,544	8,986	15,198	19,501
Gas Plant Operating	838	843	847	961	1,148	1,238
Total Operating	2,950	4,320	7,391	9,947	16,346	20,739
ADMINISTRATION & OVERHEAD	2,288	5,331	11,778	15,618	18,423	22,589
ROYALTIES	1,663	3,558	6,204	7,358	14,193	18,113
FINANCIAL						
Interest & Dividends	2,271	3,109	3,680	5,567	6,202	7,124
Income Tax	1,349	1,600	1,064	1,437	2,052	3,717
Total Financial	3,620	4,709	4,744	7,004	8,254	10,841
Total Cash Expenditures	30,453	66,904	140,505	186,164	225,098	277,432

Sources: See appendix to Chapter 2.

FUNCTIONAL EXPENDITURE SUMMARIES - SECTION I

(Amounts of dollars)

	1967	1968	1969	1970	1971	1972
EXPLORATION						
Land Acquisition & Retention	1,000	12,571	30,771	26,136	26,851	21,215
Surveys & Interpretation	2,344	8,350	31,206	87,585	41,340	40,649
Exploratory Drilling	4,027	8,000	15,210	16,270	20,600	3,401
Total Exploration	8,027	28,921	67,056	129,811	88,791	121,265
DEVELOPMENT						
Development Drilling	7,346	14,160	21,000	41,710	16,300	42,000
Producing & Lease Equip.	1,022	3,040	7,822	11,347	12,321	15,745
Gas Plant & Equip.	-	-	2,000	2,800	2,000	2,750
Other	745	1,135	2,000	2,272	3,200	2,750
Total Development	9,113	18,335	32,822	58,129	74,101	63,295
OPERATING						
Lease & Well Operating	3,170	5,277	6,329	8,088	12,160	16,817
Gas Plant Operating	83	288	497	801	1,166	1,889
Total Operating	3,250	5,565	7,851	8,887	14,240	20,724
ADMINISTRATION & OVERHEAD	2,182	6,345	12,772	18,012	19,120	24,212
DEPLETION	1,402	2,188	5,201	7,368	14,123	18,112
FINANCING						
Interest & Dividends	2,201	2,000	2,000	1,887	2,082	1,124
Income Tax	3,348	1,000	1,000	1,177	2,032	3,717
Total Financing	5,549	3,000	3,000	3,064	4,114	4,841
Total Cash Expenditures	29,523	64,352	134,302	196,181	245,540	272,452

Source: Des Appendix to Charter A.

Land acquisition and retention costs, the first item listed under exploration costs, include the cost of acquiring and retaining the right to drill for and produce petroleum from underground reservoirs. This is usually granted by a form of Petroleum and Natural Gas lease. Provincial Petroleum and Natural Gas Reservations are a form of incomplete lease giving the holder the right to drill but not to produce, together with an option to lease a portion of the block. Large sums paid for leases on proven acreage are included here, and while these may not be exploration costs in the strictest sense, they do not fit as readily into any other category. Furthermore, from the point of view of an individual company, this method of acquiring reserves is an alternative to finding one's own, through exploration, offering fewer risks if a somewhat lower return. Payments for leases and reservations may include:

1) A bonus paid to the mineral owner for granting the lease, which may range from a few cents per acre in areas of unknown prospectiveness to several thousand dollars an acre for acreage likely to be highly productive.

2) Annual rentals, sometimes called "delay rentals", paid by the oil company or "operator" to the mineral owner until production commences.

3) A royalty payment contingent on production. Royalties may be considered as a deferred acquisition cost. (Income tax authorities in the United States have taken the opposite view, namely, that a bonus payment is a prepayment of royalty). Due to their contingent nature and the fact that payment doesn't begin until development has been completed, they have been treated as a separate item below.

Land conservation and reclamation, during Ivory Coast's under exploitation, include the need of a ministry and authoritarian right to draft for and produce petroleum from underground reservoirs. This is usually granted by a form of concession and Natural Gas Lease. Provincial Governors and Natural Gas Commissions are a form of monopoly zones giving the holder the right to drill for oil or petroleum. Exploiters which are certain to lease a portion of the blocks. Large areas sold for leases or private interest are unclear here, and while lease may not be exploitation ceases in the operation zones, they do not to be really low exploitation necessary. Furthermore, from the point of view of an individual company, this method of acquiring reserves is an alternative to finding one's own, through exploration, offering lower risks if a commercial lower return. Disposition for leases and reservations may include:

1) A lease plan in the mineral owner for granting the lease, which may range from 1 year being low rate 3 years of minimum prospectivities to several thousand dollars a year for average block to be higher prospective.

2) Annual rentals, sometimes called "dead rentals", paid by the company or "producer" to the mineral owner until production commences.

3) A royalty payment contingent on production. Royalties may be measured at a specific production rate. Income tax authorities in the United States have taken the opposite view, namely, that a bonus payment is a payment made to obtain. One is usually contingent upon and the lease payment based upon with development has been completed, and the mineral owner's production lease taken.

Land costs have been considered to include bonus payments and rentals, as well as certain minor additional fees charged by the Provincial government on Crown acreage. Most mineral rights in Alberta are owned by the Crown, the bulk of the remainder being owned by the railways and the Hudson's Bay Company. Details of ownership are shown in Table 4.

TABLE 4.

Ownership of Mineral Rights in the Province of Alberta (2)

Owner	Millions of Acres	Percent
Crown (Provincial)	132.6	81.1
Crown (Federal)		
a. National Parks	13.4	8.2
b. Indian Reserves	1.3	0.8
Railways	13.1	8.0
Hudson's Bay Company	2.4	1.5
Other Freeholders	0.6	0.4
	163.4	100.0

The Provincial government has received a larger share of the monies spent for this purpose than its share of the acreage would indicate, since it has been more successful than the other mineral owners in obtaining the maximum prices for its properties. In the early years of our study, a larger portion went to private mineral owners who happened to have concentrated holdings where the first fields were found. A detailed breakdown of the land acquisition and retention costs shown in Table 3 will be found in Table A2-6 of the Appendix to this Chapter.

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(2) Somerville, H.H., Alberta's Mineral Resources, Oil in Canada, vol.V no.17 (March 2, 1953) p.22.

Land coals have been considered to include some petroleum and metals, as well as certain minor substances. Land has always be the Provincial government's on Crown [illegible]. Most mineral rights in Alberta are owned by the Crown, the bulk of the remainder being owned by the railways and the Hudson's Bay Company. Details of ownership are shown in Table 4.

TABLE 4.

Ownership of Mineral Rights in the Province of Alberta (3)

Owner	Millions of Acres	Percent
Crown (Provincial)	102.6	[illegible]
Crown (Federal)		
a. National Parks	15.4	[illegible]
b. Indian Reserves	1.3	[illegible]
Railways	10.1	[illegible]
Hudson's Bay Company	3.4	[illegible]
Other Freeholders	[illegible]	[illegible]
	132.4	100.0

The Provincial government has retained a larger share of the royalty spent for this purpose than the share of the royalty would indicate, since it has been more successful than the other owners in obtaining the maximum return for its properties. In the early years of our study, a larger portion went to private mineral owners who happened to have concentrated holdings along the River Valley area land. A detailed breakdown of the land acquisition and production costs shown in Table 5 [illegible] in Table 5.5-6 of [illegible]

(3) Somerville, [illegible] Alberta Mineral Resources, [illegible] Conservation [illegible]

The second item listed under "Exploratory Expenditures" is the cost of geological and geophysical surveys. Besides the cost of operating the familiar reflection seismographs seen throughout the province, it includes the cost of using other geophysical tools such as the refraction seismograph used in the foothills area for mapping deep and complex structures, gravity meters and magnetometers used chiefly for reconnaissance, together with a wide variety of geological surveys and research studies.

Most geophysical operations are conducted by contractors who supply field equipment and personnel and who do the work and turn over the records and usually an interpretation of the results to the operator. The latter may, particularly if it is a large company, have its own staff of geophysicists examine and rework the results. Cost of the reinterpretation and supervision by operating companies of contract crews working for them has been included in this category. While some companies operate their own crews, it has been assumed here that all geophysical work is done by contractors. In other words, the direct cost of having field work done, whether by a contractor or by the company's own geophysical department, is shown here as a payment for services made to the service companies in Sector II, though some "service companies" may be, in reality, the geophysical departments of operating companies. The cost of reworking and reinterpretation done by the companies' own staffs is, of course, shown as a direct factor payment from Sector I to Sectors III, IV and V.

Some surface geological surveys are also carried out by consulting firms, but the proportion is much smaller and such firms have been ignored in an attempt to allocate the payments directly to the factors involved.

The other principal form of geological survey which is considered as a

The second item listed under "Miscellaneous Equipment" is the cost of geological and geophysical surveys. Besides the cost of operating the fathometer reflection seismographs seen throughout the province, it includes the cost of using other geophysical tools such as the refraction seismograph used in the foothills area for mapping deep and complex structures, gravity meters and magnetometers used widely for reconnaissance, together with a wide variety of geological surveys and exploratory drilling.

Most geophysical operations are performed by contractors who supply field equipment and personnel and who do the work and turn over the records and usually an interpretation of the results to the operator. The latter may, particularly if it is a large company, have its own staff of geophysicists examine and rework the results. Cost of the interpretation and supervision by operator's companies of contract crews working for them has been included in this category. While some companies operate their own crews, it has been assumed here that all geophysical work is done by contractors. In other words, the direct cost of having field work done, whether by a contractor or by the company's own geophysical department, is shown here as a payment for services made to the service companies in Section II. Certain some "service companies" may be, in reality, the geophysical departments of operating companies. The cost of reworking and further evaluation done by the companies' own staffs is, of course, shown as a direct factor expense from Section I to Sections III, IV and V.

Some surface geological surveys are also carried out by consulting firms, but the proportion is much smaller and such firms have been ignored in an attempt to allocate the work done directly to the Canadian territories.

The other principal item of geological survey, which is considered as a

separate item here is structure test drilling, often referred to as core drilling, although no cores are taken in most cases. Exploration of this type, which is valuable in establishing subsurface correlations in many areas , is usually carried on by contractors, and payments for structure test drilling have been treated in the same manner as direct geophysical expenditures, i.e., as payments from Sector I to Sector II.

A breakdown of the estimated cost of surveys as shown in Table 3, is to be found in Table A2-10 of the Appendix to this chapter.

While geology and geophysics are quite effective in locating structures which might be oil reservoirs, no method has yet been devised which enables the location of oil or gas in the ground until a well has been drilled. Consequently, a large part of the cost of exploration for oil and gas still consists of the cost of drilling exploratory or "wildcat" wells, most of which prove on completion to be non-productive or "dry". Table 5 gives some idea of the relative proportion of successes or failures. While the success ratio in Canada seems to be slightly better than in the U.S. in the years for which data have been published, the difference is not great. Another factor of importance is the size of pool found by the successful wildcat. From what data are available on this question, it is probably safe to say that Canada has so far been better off in this regard(3).

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(3) Canadian data appear in The Financial Post, December 4, 1954. Comparable U.S. data appear in Lahee, F.H., Exploratory Drilling in 1952, A.A.P.G. Bulletin, vol.37, no.6, June 1953 and annual June issues.

separate lines been in wildcat test drilling, other reported as one drilling, although no correlation taken in most cases. Exploration of the type, which is subsidiary establishing subsurface correlations in many areas, is usually carried on by contractors, and payments for structure test drilling have been treated in the same manner as direct geological expenditures, i.e., as separate from Sector I to section II.

A breakdown of the estimated cost of surveys as shown in Table 3, is to be found in Table 4-(1) of the Appendix to this chapter.

While geology and geophysics are quite effective in locating structures which might be oil reservoirs, no method has yet been devised which enables the location of oil or gas in the ground until a well has been drilled. Consequently, a large part of the cost of exploration for oil and gas still consists of the cost of drilling exploratory or "wildcat" wells, most of which prove on completion to be non-productive or "dry". Table 4 gives some idea of the relative proportion of successes or failures. While the success ratio in Canada seems to be slightly better than in the U.S. for the years for which data have been published, the difference is not great. Another factor of importance is the size of pool found by the successful wildcat. From what data are available on this question, it is probably safe to say that Canada has so far been better off in this regard(2).

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(2) Canadian data appear in The Financial Post, December 1, 1954. Comparable U.S. data appear in Lahee, F.H., Exploratory Drilling in 1952, A.A.A.G. Bulletin, Vol. 37, No. 8, June 1953 and annual June issues.

TABLE 5

Exploratory Drilling Results in Alberta and the U.S.

Year	U.S.A. (4)				Alberta (4)			
	Oil	Gas	Dry	% Dry	Oil	Gas	Dry	% Dry
1947	981	397	5,397	79.7	Not Available			
1948	1,098	365	6,550	81.7	21	12	116	77.9
1949	1,406	424	7,228	79.8	27	21	186	79.5
1950	1,583	431	8,292	80.3	44	19	178	72.9
1951	1,763	454	9,539	81.1	52	73	285	69.5
1952	1,776	559	10,090	81.1	96	73	382	69.3

Drilling a "wildcat" is more costly than drilling a development well in an area of proven production, in that drilling must proceed more cautiously where not too much is known about subsurface conditions, both for safety and to ensure the adequate testing of all prospective geological horizons. The additional coring, testing, logging and supervision necessary raises costs for these items and transportation costs into remote areas are always greater for the first well than for its successors. Wildcat drilling is so expensive that any geological or geophysical technique that tips the odds sufficiently in favour of the operator is a worthwhile investment.

As with geophysical operations, most drilling of wells, whether wildcats or development, is done by contractors and a small portion by rigs owned by the operating companies. The treatment used here for company-owned drilling rigs parallels that used for company-operated geophysical crews, in that departments performing both services are treated as separate service companies. That portion of the cost of drilling which would accrue to a con-

(4) F. H. Lahee - A.A.P.G. Bulletin, June 1949, 1950, 1951, 1952 and 1953.

TABLE I

Manufacturing Drilling Operations of Petroleum (1)

Year	U.S.A. (A)				Abroad (B)			
	Total	Gas	Oil	Mining	Total	Gas	Oil	Mining
1947	[illegible]	327	3,927	75,7	Data unavailable			
1948	1,[illegible]	395	4,[illegible]	91,7	[illegible]	[illegible]	[illegible]	[illegible]
1949	1,[illegible]	[illegible]	3,[illegible]	77,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]	94,3	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	91,1	[illegible]	[illegible]	[illegible]	[illegible]
1952	1,[illegible]	[illegible]	[illegible]	91,1	[illegible]	[illegible]	[illegible]	[illegible]

Drilling a "wildcat" is more costly than drilling a development well in proved crude production. In the drilling phase, proved crude production, but too much is known about subsurface conditions, however, the above advantage the economic feasibility of this preliminary geological drilling, this additional costly, testing, logging, and supplies necessary to complete these steps and recommendation comes into remote areas for drilling, provide for the first work in the accessory. Without drilling, a geologist, that any geological or geophysical information that can be [illegible] layout of the operations is a substantial investment.

As with geological operations, total drilling is varied, including drilling or development, in order to construct and a small portion of the [illegible] the operating conditions. The demand data for [illegible] drilling rigs [illegible] for [illegible] drilling rigs, [illegible] that depending on [illegible] drilling [illegible] [illegible] [illegible]. That drilling, if the case is drilling [illegible] [illegible]

(1) [illegible] Petroleum Industry, New York, [illegible], [illegible] and [illegible].

tractor is shown as a payment to Sector II, while factor payments for the operation of rigs are shown as expenditures by Sector II.

It is common accounting practise in the industry to include a portion of overhead costs in exploration costs. As any method of allocation must be to some extent arbitrary, it was felt that no useful purpose would be served by attempting such an allocation here and administrative cost has been considered separately.

Once an oilfield has been discovered, substantial further expenditures are necessary before production begins on a commercial scale. Development wells must be drilled, flowlines, treaters, separators and storage tanks installed, and office space provided for operating personnel. After a field has been nearly developed, and if substantial volumes of gas are produced along with the oil, and if the field is large enough to justify the investment, a gas conservation plant may be needed to treat wet gas, removing liquid products such as propane, butane and natural gasoline from the gas before it is delivered to a pipeline. In the case of a field producing wet gas only, such a plant must be erected before any production occurs.

The largest single item of development cost is incurred in the drilling of development wells. One of the chief economic problems of the industry in the United States has been overdevelopment resulting from the drilling of more wells in a pool than required to insure drainage, and in some cases more wells than will ever return the operator's investment. This problem has a number of causes which need not be discussed here, but it is desirable to mention at this point that while the problem is not wholly absent in Alberta, well spacing regulations of the Oil and Gas Conservation Board have reduced its seriousness. Besides drilling a well, certain equipment must be provided

before it can be produced. A string of tubing is necessary in each well to bring the oil to the surface, where a wellhead controls its flow. In many cases a pump is needed as the well will not flow of its own accord. Once the oil is above ground, it flows to a battery through a flowline. Here it may be processed in a separator to remove dissolved gas, a treater to break up salt water emulsions, and is stored awaiting delivery to the purchaser. The cost of these producing facilities is shown as Pumping and Lease equipment in Table 3. Details of the cost of such equipment will be found in Table A2-19 of the Appendix to Chapter 2.

As a result of the increasing emphasis placed on the conservation of oil and gas resources, both by the government and by responsible industry leaders, gasoline plants are being built in every field where they are economically justified. There will be no repetition of the old Turner Valley practise of stripping the liquid fractions from wet gas, then burning the gas in flares. This practise was not only wasteful of gas but will result in millions of barrels of oil being left in the ground in that field, due to the premature dissipation of reservoir energy. Present regulations will not allow gas to be produced except for sale or if it is in solution with oil, and if the latter is the case, all possible care must be taken to save the gas either to sell or to re-inject to maintain reservoir pressures. As a result, several plants have been installed to conserve this gas. Only two such plants were completed in Alberta in the period under review. The Imperial Oil Limited plant at Devon handles gas from the Leduc-Woodbend field. It went into operation in July, 1950, and had an original capacity of 18,000 Mcf per day(5) and cost some $4 million (6). By the end of 1952, capacity was increased to

(5) Imperial Oil Limited, Annual Report, 1950
(6) Canadian Oil and Gas Industries, October, 1952, p.31.

24,000 Mcf per day at an additional cost of some $3 million (7).

The second plant was built at Jumping Pound by the Shell Oil Company in 1951. Its original capacity was 25,000 Mcf per day and it originally cost $1.5 million (8). Expansion and addition of a sulphur recovery unit cost another $400,000 in 1952 (9). In addition to the above new plants, an addition was made by Royalite Oil Company Limited to its Turner Valley plant in the form of a sulphur recovery unit installed in 1952 at a cost of $350,000 (10). Table 6 summarizes gas plant costs.

TABLE 6

Cost of Gas Plants, Gathering Systems and Related Facilities
Alberta 1947 - 1952
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Imperial (Devon)	-	-	2,000	2,000	1,000	2,000
Shell (Jumping Pound	-	-	-	500	1,000	400
Royalite (Turner Valley)	-	-	-	-	-	350
	-	-	2,000	2,500	2,000	2,750

Besides the above installations which are peculiar to the petroleum industry, field offices, warehouses, firefighting equipment and other facilities common to all large industrial undertakings must be provided. These items are included in the category "Other Development Costs".

Operating expenses directly related to the operation of wells (excluding depreciation) form a small part of the cost of producing oil and gas. This combination of low out-of-pocket expense and high investment in specialized

(7) Daily Oil Bulletin, June 15, 1956.
(8) Canadian Oil and Gas Industries, October, 1952, p.31
(9) Shell Oil Company of Canada Limited, The Canadian Petrochemical Industry, Toronto, 1956, p.81
(10) World Petroleum, May, 1952, p.75

24,000 bbl per day at an additional cost of some 23 million (7).

The second plant was built at Imperial Point by the Shell Oil Company in 1951. Its original capacity was 25,000 bbl per day and it originally cost 11.5 million (8). Expansion and addition of a sulphur recovery unit cost another $500,000 in 1952 (9). In addition to the above new plants, an addition was made by Borealis Oil Company Limited to its Turner Valley plant in the form of a sulphur recovery unit installed in 1951 at a cost of $550,000 (10). Table 5 summarizes gas plant costs.

TABLE 5

Cost of Gas Plants, Refinery Systems and Related Facilities
Alberta 1947 - 1952
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Imperial (Devon)	-	-	2,000	2,000	1,700	2,000
Shell (Turning Point)	-	-	-	500	1,400	500
Royalite (Turner Valley)	-	-	-	-	-	250
	-	-	2,000	2,500	3,000	2,750

Besides the above installations which are peculiar to the petroleum industry, field offices, warehouses, firefighting equipment and other facilities common to all large industrial undertakings must be provided. These items are included in the category "Other Development Costs".

Operating expenses directly related to the operation of wells (including depreciation) form a small part of the cost of producing oil and gas. This combination of low out-of-pocket expense and high investment is especially

(7) Daily Oil Bulletin, June 13, 1954.
(8) Canadian Oil and Gas Industries, October, 1954, p.82.
(9) Shell Oil Company of Canada Limited, The Canadian Petroleumeisal Industry, Toronto, 1956, p.81
(10) World Petroleum, May, 1956, p.75

facilities gave the petroleum industry many of the attributes of a "sick industry" in the United States until stabilized by government controls in the mid-1930's. The pattern of the industry prior to that time was one of recurrent feast and famine as high prices encouraged drilling which was aggravated by competitive ownership of pools until an oversupply of crude cut prices to, or even (for short periods) below out-of-pocket costs. This, in turn, encouraged excessive producing rates in an effort to meet operating expenses, causing rapid depletion of existing pools, and prices rose until a new bout of drilling started. This has never been much of a problem in western Canada as demand consistently exceeded supply prior to 1950, by which time the legal apparatus for the prorationing of production to market demand was set up.

Operating expenses shown here include lease and well operating expense and gas plant operating expense. The first of these classes includes the cost of pumping and measuring crude, metering gas, salt water removal and disposal, repairs to wells and equipment, the maintenance of lease roads, Municipal Property taxes, etc.

There is one remaining category of expenditures which relates to operations, but cannot be tied directly to exploration, development or operating expense. This includes the cost of administering the huge expansion program and is made up of a wide variety of overhead costs. Some capital items such as office buildings have been treated in the same manner as drilling rigs, and it has been assumed that they are all rented from "service companies" in Sector II. Rental charges have been shown as a payment from Sector I to Sector II, while building costs are shown as a payment by Sector II to Sectors III, IV and V.

Royalties paid to mineral owners are shown as a separate class of ex-

facilities gave the petroleum industry many of the problems of a "sick industry" in the United States until stabilized by government controls in the mid-1930's. The pattern of the industry prior to that time was one of recurrent feast and famine as high prices encouraged drilling which was aggravated by competitive ownership of pools until as overcapacity of crude not needed to, or even (for short periods) below cost-of-product ones. This, in turn, encouraged excessive producing rates in an effort to meet operating expenses, causing rapid depletion of stripping pools, and premature loss until a new boom of drilling started. This has never been notes of a problem in western Canada. The demand consistently exceeded supply prior to 1930, by which time the legal apparatus for the prorationing of production to market demand was set up.

Operating expenses about half are labor and well operating expenses and gas plant operating expenses. The first of these classes includes the cost of pumping and measuring crude, restoring gas, salt water removal and disposal, repairs to wells and equipment, the maintenance of lease roads, allocated property taxes, etc.

There is one remaining category of expenditures which relates to operations, but cannot be tied directly to production, development or operating expenses. This includes the cost of establishing the large expansion programs and is made up of a wide variety of overhead costs. Some capital items such as office buildings have been treated in the same manner as drilling rigs, and it has been assumed that they are all vested from "service companies" in Sector II. Rental charges have been shown as a payment from Sector I to Sector II, while building costs are shown as a payment by Sector II to Sectors III, IV and V.

Royalties paid to external owners are shown as a separate class of ex-

penditures, as mentioned above. This treatment is in accord with customary accounting practise which treats royalties paid not as an operating expense, but as oil belonging to the mineral owner and sold for him by the operator. Some leases provide the mineral owner with the option of taking royalty oil in kind. Royalty payments are one of the principal forms of direct benefit to Albertans resulting from the growth of the oil producing industry in the province, and will become more important as the amount of settled production in relation to new development increases.

The final classification of expenditures is "financial payments", so called because they do not relate in amount directly to operations. The first class of these includes payments made by oil producers for the use of capital, namely, dividend and interest payments. Income taxes form the second class. These two types of payments have not been considered in other analyses of spending, but are of significance, and their inclusion is desirable in the overall picture. During the period under review they are not large in amount, but they should increase materially in the next decade as more companies reach a profitable stage in their operations. Their inclusion will be imperative in future studies.

The estimates presented in this Chapter give a picture of the scale and purpose of the expenditures made by the industry during the period in which it grew from insignificant beginnings to become a major factor in Alberta's growing industrial complex. Subsequent chapters will trace the geographic pattern of flow of funds into and out of the province, for the industry itself and for the several satellite industries which have grown up around it.

CHAPTER 3

ALLOCATION OF SECTOR I EXPENDITURES

In this Chapter, the functional expenditure estimates of Chapter 2 are traced to Sectors II, III, IV and V. Payments to Sector II are those made to intermediate or "service companies" such as drilling contractors, cementing companies, geophysical contractors, general contractors building plant facilities, owners of office buildings leased to oil companies, etc., or to the equivalent departments of integrated companies. In a sense these firms are part of the oil industry. Payments to Sectors III, IV and V represent payments directly to residents of Alberta, other parts of Canada, or foreign countries, respectively. In Chapter 5, payments to Sector II are also allocated to Sectors III, IV and V.

This distinction is made because Sector I expenditures represent cash expenditures from the point of view of the operating companies, while from the point of view of the rest of the economy, these expenditures must be consolidated with those of the Sector II companies to give a complete picture of the industry's expenditures. This aggregation is necessary if we are to judge the economic impact of the growth of the industry. They are kept separate at this stage in order to enable certain cost comparisons, etc., which are more accurately made on the basis of operators' expenditures.

Table 7 summarizes the resulting allocation of expenditures by operating companies, while Tables 8 to 13 give a more detailed breakdown, item by item, and year by year. In general, the method used was to determine the percentage breakdown of each class of functional payments. These percentages were then applied to the estimates of the latter to determine their al-

APPENDIX B

ALLOCATION OF SECTOR I EXPENDITURES

In this Chapter, the functional expenditure estimates of Chapter 2 are traced to Sectors II, III, IV and V. Payments to Sector II are those made to intermediate or "service companies" such as drilling contractors, geophysical companies, geological contractors, general contractors but they plant facilities, owners of office buildings leased to oil companies, etc., or to the equivalent departments of integrated companies. In a sense these firms are part of the oil industry. Payments to Sectors III, IV and V represent payments directly to residents of Alberta, other parts of Canada, or foreign countries, respectively. In Chapter 3, payments to Sector II are also allocated to Sectors III, IV and V.

This distinction is made because Sector I expenditures represent cash expenditures from the point of view of the operating companies, but they are from the point of view of the rest of the economy, "intermediate" in the sense that as contrasted with those of the Sector II companies, they give complete pictures of the industry's expenditures. This aggregation is necessary if we are to judge the economic impact of the growth of the industry. They are kept separate at this stage in order to enable certain cost comparisons, etc., which are more accurately made on the basis of operating expenditures.

Table 7 summarizes the resulting allocation of expenditures by operating companies, while Tables 8 to 13 give a more detailed breakdown, item by item, and year by year. In general, the procedure was to determine the percentage breakdown of each class of operating payments. These percentages were then applied to the estimates of the expenditures during the di-

location between Sectors. Further details concerning the allocation will be found in the Appendix to this Chapter.

TABLE 7.

Allocation of Sector I Expenditures - Alberta 1947-1952
(thousands of dollars)

		Payments to			
	Total Expenditures	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
1947	30,453	14,111	7,677	4,124	4,541
1948	66,904	28,293	23,180	6,115	9,316
1949	140,505	60,706	52,473	7,727	19,599
1950	186,164	80,627	68,167	10,352	27,018
1951	225,098	107,328	72,437	12,661	32,672
1952	277,432	126,224	93,317	17,152	40,739

TABLE 8

Allocation of Functional Expenditure Estimates
Alberta - 1947
(thousands of dollars)

	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	1,680	-	900	700	80
Surveys and Supervision	3,365	2,844	468	26	27
Exploratory Drilling	4,880	3,704	390	-	786
Total Exploration	9,925	6,548	1,758	726	893
Development					
Development Drilling	7,940	6,026	636	-	1,278
Pumping and Lease Equip.	1,352	-	118	59	1,175
Gas Plants & Equipment	-	-	-	-	-
Other	715	715	-	-	-
Total Development	10,007	6,741	754	59	2,453
Operating					
Lease & Well Operating	2,112	422	1,352	148	190
Gas Plant Operating	838	-	754	84	-
Total Operating	2,950	422	2,106	232	190
Administration & Overhead	2,288	400	1,185	140	563
Royalties	1,663	-	1,079	357	227
Financial					
Interest & Dividends	2,271	-	789	1,267	215
Income Tax	1,348	-	6	1,343	-
Total Financial	3,620	-	795	2,610	215
Total Cash Expenditures	30,453	14,411	7,677	4,124	4,541

EXHIBIT 2

Allocation of Functional Expenditure Estimates
Alberta - 1977
(Thousands of Dollars)

	Expenditures	Receipts			
	Sector I (Operator)	Sector II (Service Co.)	Sector III (Alberta)	Sector IV (Government of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	1,880	-	800	780	80
Survey and Supervision	3,355	2,144	460	26	27
Exploratory Drilling	4,290	3,724	550	-	766
Total Exploration	9,525	5,868	1,810	806	873
Development					
Development Drilling	7,840	6,026	852	-	3,972
Pumping and Lease Equip.	1,372	-	310	50	1,175
Gas Plants & Equipment	-	-	-	-	-
Other	715	144	-	-	-
Total Development	10,007	6,144	764	50	5,447
Operating					
Lease & Well Operating	2,112	432	1,202	145	106
Gas Plant Operating	768	-	704	34	-
Total Operating	2,880	432	1,906	243	106
Administration & Overhead	2,288	[illegible]	1,180	140	848
Royalties	1,080	-	1,070	887	227
Financial					
Interest & Dividends	2,271	-	780	1,207	212
Income Taxes	1,319	-	[illegible]	1,320	-
Total Financial	3,590	-	780	2,510	212
Total Cash Expenditures	30,452	12,[illegible]	7,877	4,136	8,844

TABLE 9

Allocation of Functional Expenditure Estimates
Alberta - 1948
(thousands of dollars)

Item	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	12,271	-	11,171	925	175
Surveys and Supervision	9,450	8,322	1,014	57	57
Exploratory Drilling	8,890	6,749	710	-	1,431
Total Exploration	30,611	15,071	12,895	982	1,663
Development					
Development Drilling	14,140	10,732	1,131	-	2,277
Pumping & Lease Equip.	3,040	-	264	134	2,642
Gas Plants & Equipment	-	-	-	-	-
Other	1,195	1,195	-	-	-
Total Development	18,375	11,927	1,395	134	4,919
Operating					
Lease & Well Operating	3,477	695	2,226	243	313
Gas Plant Operating	843	-	759	84	-
Total Operating	4,320	695	2,985	327	313
Administration & Overhead	5,331	600	2,690	408	1,633
Royalties	3,558	-	2,338	760	460
Financial					
Interest & Dividends	3,109	-	862	1,919	328
Income Tax	1,600	-	15	1,585	-
Total Financial	4,709	-	877	3,504	328
Total Cash Expenditures	66,904	28,293	23,130	6,115	9,316

TABLE 4

Allocation of Exploration Expenditures
Alberta - 1966
(Thousands of Dollars)

Item	Expenditures	Sources			
	Total	Service Co. (Operating)	Service Co. (Alberta)	Industry (Total of Canada)	Industry (Total of World)
Exploration					
Land Acquisition & Retention	13,371	-	11,371	800	1,176
Geology and Geophysics	9,450	8,812	1,112	37	37
Exploratory Drilling	8,200	6,948	118	-	1,134
Total Exploration	31,021	15,760	12,601	837	2,347
Development					
Development Drilling	11,140	10,343	1,131	-	2,277
Production & Lease Equip.	5,500	-	396	124	2,843
Gas Plants & Equipment	-	-	-	-	-
Other	1,136	1,136	-	-	-
Total Development	18,776	11,021	1,527	124	5,212
Operating					
Lease & Well Operating	5,477	989	3,370	343	815
Gas Plant Operating	643	-	188	81	-
Total Operating	6,120	989	3,558	424	815
Administration & Overhead	8,881	600	3,000	109	1,203
Royalties	2,[illegible]	-	7,[illegible]	700	300
Financial					
Interest & Dividends	9,104	-	865	1,819	328
Income Tax	1,500	-	15	1,485	-
Total Financial	9,708	-	877	3,301	328
Total Cash Expenditures	96,[illegible]	28,[illegible]	28,[illegible]	6,[illegible]	9,[illegible]

TABLE 10

Allocation of Functional Expenditure Estimates - Alberta - 1949
(thousands of dollars)

Item	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	30,771	-	29,341	1,150	280
Surveys and Supervision	21,005	18,747	2,032	113	113
Exploratory Drilling	15,710	11,921	1,257	-	2,532
Total Exploration	67,486	30,668	32,630	1,263	2,925
Development					
Development Drilling	31,000	23,529	2,480	-	4,991
Pumping & Lease Equip.	7,602	-	662	334	6,606
Gas Plants & Equipment	2,000	2,000	-	-	-
Other	2,300	2,300	-	-	-
Total Development	42,902	27,829	3,142	334	11,597
Operating					
Lease & Well Operating	6,544	1,309	4,188	458	589
Gas Plant Operating	847	-	762	85	-
Total Operating	7,391	1,309	4,950	543	589
Administration & Overhead	11,778	900	6,600	855	3,423
Royalties	6,204	-	4,402	1,116	686
Financial					
Interest & Dividends	3,680	-	738	2,563	379
Income Tax	1,064	-	11	1,053	-
Total Financial	4,744	-	749	3,616	379
Total Cash Expenditures	140,505	60,706	52,473	7,727	19,599

Table [illegible]

Allocation of Functional Expenditure Estimates –
[illegible] – 1969
(Thousands of Dollars)

Item	Exploration (Operations)	Development (Operations)	Production (Operations)	Service to Others (Other Cos.)	Service to Others (Other Cos.)	Service to Others (Other Cos.)
Exploration						
Land Acquisition & Exploration	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Survey and Supervision	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Exploratory Drilling	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]
Total Exploration	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Development						
Development Drilling	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]
Pumping & Lease Equip.	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Gas Plants & Equipment	[illegible]	[illegible]	-	-	-	-
Other	[illegible]	[illegible]	-	-	-	-
Total Development	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Operating						
Lease & Well Operating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gas Plant Operating	[illegible]	-	[illegible]	[illegible]	[illegible]	-
Total Operating	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Administration & Overhead	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Royalties	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Financial						
Interest & Dividends	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Income Tax	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Total Financial	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]
Total Cash Expenditures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 11

Allocation of Functional Expenditure Estimates
Alberta - 1950

(thousands of dollars)

Item	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	39,156	-	37,556	1,300	300
Surveys & Supervision	27,955	25,012	2,649	147	147
Exploratory Drilling	16,200	12,294	1,297	-	2,609
Total Exploration	83,311	37,306	41,502	1,447	3,056
Development					
Development Drilling	46,700	35,445	3,736	-	7,519
Pumping & Lease Equip.	11,347	-	987	499	9,861
Gas Plants & Equipment	2,500	2,500	-	-	-
Other	2,379	2,379	-	-	-
Total Development	62,926	40,324	4,723	499	17,380
Operating					
Lease & Well Operating	8,986	1,797	5,751	629	809
Gas Plant Operating	961	-	865	96	-
Total Operating	9,947	1,797	6,616	725	809
Administration & Overhead	15,618	1,200	8,920	1,099	4,399
Royalties	7,358	-	5,550	1,194	614
Financial					
Interest & Dividends	5,567	-	845	3,962	760
Income Tax	1,437	-	11	1,426	-
Total Financial	7,004	-	856	5,388	760
Total Cash Expenditures	186,164	80,627	68,167	10,352	27,018

TABLE 12

Allocation of Functional Expenditure Estimates
Alberta - 1951
(thousands of dollars)

Item	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	28,961	-	27,185	1,431	345
Survey & Supervision	41,140	36,899	3,817	212	212
Exploratory Drilling	24,600	18,673	1,967	-	3,960
Total Exploration	94,701	55,572	32,969	1,643	4,517
Development					
Development Drilling	56,200	12,656	4,496	-	9,048
Pumping & Lease Equip.	12,521	-	1,089	551	10,881
Gas Plants & Equipment	2,000	2,000	-	-	-
Other	2,460	2,460	-	-	-
Total Development	73,181	47,116	5,585	551	19,929
Operating					
Lease & Well Operating	15,198	3,040	9,726	1,064	1,368
Gas Plant Operating	1,148	-	1,033	115	-
Total Operating	16,346	3,040	10,759	1,179	1,368
Administration & Overhead	18,423	1,600	10,910	1,182	4,731
Royalties	14,193	-	11,369	1,883	941
Financial					
Interest & Dividends	6,202	-	831	4,185	1,186
Income Tax	2,052	-	14	2,038	-
Total Financial	8,254	-	845	6,223	1,186
Total Cash Expenditures	225,098	107,328	72,437	12,661	32,672

TABLE 19

Allocation of Exploration-Production Expenditures
Atlantic - 1951
(Thousands of Dollars)

Item	Expenditure	Recovery			
	Basic - F (Depletion)	Factor G (Depletion Less)	Factor H (Allowance)	Factor IV (Less of Cases)	Factor V (Less of Events)
Exploration					
Land Acquisition & Retention	23,981	-	46,185	1,487	315
Survey & Supervision	45,140	52,040	7,817	212	212
Exploratory Drilling	24,300	16,871	1,947	-	3,680
Total Exploration	93,421	68,072	55,949	1,699	4,217
Development					
Development Drilling	84,200	14,055	4,498	-	5,049
Producing & Lease Equip.	14,321	-	1,080	381	10,891
Gas Plant & Equipment	4,000	2,000	-	-	-
Other	2,400	2,400	-	-	-
Total Development	104,921	18,455	5,578	381	15,940
Operating					
Lease & Well Operating	16,140	3,040	[illegible]	1,024	1,250
Gas Plant Operating	1,140	-	1,028	119	-
Total Operating	17,280	3,040	10,708	1,143	1,250
Administration					
& Overhead	16,815	1,000	10,810	1,161	4,751
Royalties	14,190	-	11,300	1,038	241
Financial					
Interest & Dividends	8,200	-	341	4,185	1,180
Income Tax	2,000	-	14	2,838	-
Total Financial	8,200	-	355	7,023	1,180
Total Cash Expenditures	254,800	107,515	70,600	12,241	32,619

TABLE 13

Allocation of Functional Expenditure Estimates
Alberta - 1952
(thousands of dollars)

Item	Expenditures	Receipts			
	Sector I (Operators)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
Exploration					
Land Acquisition & Retention	41,015	-	38,510	2,105	400
Surveys & Supervision	46,440	41,620	4,338	241	241
Exploratory Drilling	34,400	26,108	2,752	-	5,540
Total Exploration	121,855	67,728	45,600	2,346	6,181
Development					
Development Drilling	62,050	17,096	4,964	-	9,990
Pumping & Lease Equip.	15,745	-	1,370	693	13,682
Gas Plants & Equipment	2,750	2,750	-	-	-
Other	2,750	2,750	-	-	-
Total Development	83,295	52,596	6,334	693	23,672
Operating					
Lease & Well Operating	19,501	3,900	12,481	1,365	1,755
Gas Plant Operating	1,238	-	1,114	124	-
Total Operating	20,739	3,900	13,595	1,489	1,755
Administration & Overhead	22,589	2,000	12,900	1,538	6,151
Royalties	18,113	-	14,008	2,873	1,232
Financial					
Interest & Dividends	7,124	-	836	4,540	1,748
Income Tax	3,717	-	44	3,673	-
Total Financial	10,841	-	880	8,213	1,748
Total Cash Expenditures	227,432	126,224	93,317	17,152	40,739

EXHIBIT 1a

Allocation of Functional Expenditure Estimates
Alberta - 1966
(Thousands of Dollars)

Item	Expenditures Sector I (Operations)	Sector II (Service Con.)	Sector III (Alberta)	Sector IV (Rest of Canada)
Exploration				
Land Acquisition & Rentals	11,015	-	10,320	2,720
Survey & Geological Operations	20,480	41,450	4,321	141
Exploratory Drilling	24,100	41,100	3,724	1,340
Total Exploration	21,575	81,750	18,365	1,361
Development				
Development Drilling	25,050	17,000	1,450	1,800
Pumping & Lease Equip.	14,140	-	1,470	400
Gas Plant & Equipment	1,760	1,760	-	-
Other	1,160	1,160	-	-
Total Development	42,105	21,320	2,920	12,070
Operating				
Lease & Well Operating	10,801	3,000	14,401	1,486
Gas Plant Operating	1,[illegible]	-	1,[illegible]	124
Total Operating	21,739	3,000	15,[illegible]	1,[illegible]
Administration & Overhead	[illegible]	2,000	14,[illegible]	1,521
Royalties	14,[illegible]	-	14,[illegible]	2,[illegible]
Financial				
Interest & Dividends	7,144	-	486	2,760
Income Tax	1,117	-	14	1,[illegible]
Total Financial	10,241	-	310	[illegible]
Total Cash Expenditures	[illegible]	[illegible]	69,417	17,[illegible]

CHAPTER 4

SOURCES OF FUNDS - SECTOR I

The enormous expenditures outlined in Chapter 2 necessitated large capital imports into the Province. It is the purpose of this Chapter to examine the sources of the funds expended by the industry, in order to determine what portion was financed from earnings, how the balance was financed, and from where the funds came.

In addition to the actual expenditures made by the industry, funds were needed to provide the working capital standing behind the expenditures. The relationship between expenditures and cash requirements can be stated briefly as follows:

Cash Expenditures PLUS Additions to Working Capital

= Cash Requirements

Unfortunately, little information on working capital needs is available, except for the balance sheets of a few companies, which show so much variability from year to year that they do not yield any worthwhile generalizations. Any estimate should also take cognizance of the working balances held by parent companies outside the province to support Alberta operations. These do not, however, represent a cash inflow in the Province until actually spent here. Because of the lack of information in this matter, it was necessary to estimate, arbitrarily, that at each year end the industry as a whole held sufficient balances to finance one-half of the next year's expenditures. While this estimate seems large at first glance in relation to the "six weeks' expenditures" rule-of-thumb applying to public utilities and the slightly larger requirement of manufacturing

CHAPTER 4

SOURCES OF FUNDS - SECTION 1

The economic expenditures outlined in Chapter 3 necessitated large capital inputs into the Province. It is the purpose of this Chapter to examine the sources of the funds expended by the industry, in order to determine what portion was financed from earnings, how the balance was financed, and from where the funds came.

In addition to the actual expenditures made by the industry, funds were needed to provide the working capital element behind the expenditures. The relationship between expenditures and cash requirements can be stated broadly as follows:

Cash Expenditures PLUS Additions to Working Capital = Cash Requirements

Unfortunately, little information on working capital needs is available, except for the balance sheets of a few companies, which show no much variability from year to year that they do not yield any worthwhile generalizations. Any estimate should also take cognizance of the working balances held by retail distributors outside the province to support their operations. There is not, however, represent a cash inflow in the Province until sale of equipment. Because of the lack of information in this manner, it was necessary to estimate, arbitrarily, that at each year end the industry as a whole did maintain balances in excess one-half of the most variable expenditures. While this estimate seems large at first glance in relation to the "cash" expenditures, "out-of-pocket" expenditures to public utilities and the slightly longer construction of transmission

companies, it must be remembered that during this period a great many of the oil companies in Alberta were active only as explorers and had no source of funds other than the capital markets. Such firms would generally not, because of the expense and inconvenience attached to small, frequent security issues have recourse to the market more than once or twice a year at most.

Viewed in this light the assumption appears more reasonable, and, while it must be emphasized that the estimate is purely arbitrary, it is felt that the inclusion of such an estimate, which appears to fit in quite well with the apparent pattern of financing, gives a more realistic picture than could be obtained by ignoring the working capital factor entirely. There is only one year, 1950, for which the results suggest that the assumption may be out of line, and in this case it appears that the six months' allowance is inadequate.

The principal sources of funds available to the Alberta petroleum industry during this period were :

1. Income from the sale of crude oil, natural gas, and other products.
2. Bank Loans.
3. Money borrowed through the issue of bonds, debentures and other debt instruments.
4. Sale of foreign assets held by the companies.
5. Equity funds advanced by shareholders either by subscription to new share issues or through direct investment by parent companies. Several minor mis-

companies, it must be remembered that during this period a great many of the oil companies in Alberta were active only as explorers and had no source funds other than the capital markets. Such firms would perhaps, not, because of the expense and inconvenience attached to small, diversed accounts issue new securities in the market more than once or twice a year at most.

Viewed in this light the arrangement appears more reasonable, and, while it must be recognized that the results are strictly arbitrary, it is felt that the inclusion of such an adjustment, which appears to fit in quite well with the apparent pattern of financing, gives a more realistic picture than would be obtained by ignoring the working capital factor entirely. There is only one year, 1951, for which the results suggest that the assumption may be out of line, and in this case it appears that the six months' adjustment is inadequate.

The principal sources of funds available to the Alberta petroleum industry during this period were :

1. Income from the sale of crude oil, natural gas, and other products.
2. Bank loans.
3. Money borrowed through the issue of bonds, debentures and other debt instruments.
4. Sale of foreign assets held by the companies.
5. Equity funds procured by shareholders either by subscription to new share issues or through direct investment in parent companies. Several issues, minor

cellaneous sources of funds are also included in this group.

In estimating the amount obtained from each source, equity investment has been treated as a residual, that is, amounts obtained from the first four sources above have been estimated separately and deducted from total capital requirements to determine the amount of equity investment.

Table 14 illustrates the calculation of total funds required.

Table 14

Funds required by the Alberta Petroleum Producing Industry

1947 - 52

(thousands of dollars)

	1946	1947	1948	1949	1950	1951	1952	1953
Estimated Cash Expenditures		30,453	66,904	140,505	186,164	225,098	277,432	310,000
Working Capital Required, Dec. 31 = 1/2 subsequent year's expenditures	15,226	33,452	70,253	93,082	112,549	138,716	155,000	---
Additions to working Capital		18,226	36,801	22,829	19,467	26,167	16,284	
Plus Annual expenditures		30,453	66,904	140,505	186,164	225,098	277,432	
Total funds required		48,679	103,705	163,334	205,631	251,265	293,716	

A substantial portion of the required funds came from the sale of crude and other products. Details of such sales appear in Table 15.

Table 15

Value of Products Sold by the Alberta Petroleum Producing Industry.

1947 - 52

(Thousands of Dollars)

Year	Crude Oil	Natural Gas	Natural Gasoline	L.P.G.	Sulphur	Tota
1947	18,079	2,205	-	-	-	20,284
1948	35,128	2,448	-	21	-	37,597
1949	59,000	2,559	-	133	-	61,692
1950	82,216	2,930	-	393	-	85,539
1951	113,567	2,995	1,664	727	-	118,953
1952	136,448	2,336	1,663	1,023	268	141,738

Sources

Crude Oil - D.B.S. Crude Petroleum Industry, 1947, 1948, Table 2, Selling Value of Products (gross), Crude Petroleum and Natural Gas Industry 1949, 1950, 1951, 1952. Table 2, Gross Selling Value of Products. Includes Natural Gasoline until 1950.

Natural Gas D.B.S. Crude Petroleum and Natural Gas Industry 1951, 1952, Table 18, 1950 Table 21. 1947 and 1948 production from 1949 ed valued at $.05 per mcf as used for 1949 production by D.B.S.

Natural Gasoline D.B.S. Crude Petroleum and Natural Gas Industry 1951, 1952, Table 10. Prior years included in Crude Oil.

L.P.G. Production figures from P & N.G.Conservation Board "Alberta Oil and Gas Industry, 1952". valued at 4¢ per gal. for butane and 7¢ fc propane, which are estimates of prevailing prices.

Sulphur - Production figures from P & N G Conservation Board, idem. valued at $30 per ton.

Bank loans to oil producers were not a very large source of funds, particularly in these early years of development. Part of the reason for this is the early unfamiliarity of bankers with oil financing problems, and their hesitancy to assume the risks of an inherently speculative business.

However, the banks eagerly sought production loan business in the later years covered by this study, and the relatively small amount of net borrowing seems to indicate that bank financing was regarded by most managements as a temporary source of funds to be used until requirements could be determined more accurately and a bond issue floated Many of the oil company bond issues, incidentally, were bought by the bank who preferred to get into the field of medium term loans in this way. Total net bank borrowings as estimated from published financial data, are shown in Table 16.

Table 16

Bank Borrowings of Alberta Oil Companies 1947-1952 (1)

(excluding bond issues held by banks)

(Thousands of Dollars)

Year	Net Increase in Debt.
1947	300
1948	2,600
1949	3,400
1950	3,600
1951	(600)
1952	(4,200)

( ) indicates net repayment.

The use of bonds, notes and debentures to raise funds was more substantial, particularly in 1950-51 when development of proven reserves in the Redwater field was proceeding rapidly. Many of these issues carried stock bonuses or conversion privileges to "sweeten" them for investors. In a number of companies floated during this period, the par value of bonds represented the total capitalization. Our statistics on borrowing apply to the smaller, non-integrated "independent" companies. Borrowings by foreign major companies were

(1) Financial Statements of publicly held companies as shown in The Financial Post Survey of Oils, various issues, adjusted.

However, the large capacity enough production took business in the later years covered by this study, and the relatively small amount of net borrowing seems to indicate that bank financing was regarded by most managements as a temporary source of funds to be used until requirements could be determined more accurately and a bond issue floated. Many of the oil company bond issues, incidentally, were bought by the bank who preferred to put into the field of medium term loans in this way. Total net bank borrowings as estimated from published financial data, are shown in Table 16.

Table 16

Net Borrowings of Alberta Oil Companies 1947-1952 (1)

(excluding bond issues held by banks)
(Thousands of Dollars)

Year	Net Increase in Debt
1947	708
1948	2,083
1949	2,400
1950	3,300
1951	(300)
1952	(4,300)

( ) Indicates net repayment.

The use of bonds, notes and debentures to raise funds was more substantial, particularly in 1950-51 when development of proven reserves in the Redwater field was proceeding rapidly. Many of these issues included stock bonuses or conversion privileges to "sweeten" them for investors. In a number of companies floated during this period, the par value of bonds represented the total capitalization. Our statistics on borrowing apply to the smaller, non-integrated "independent" companies. Borrowings by integrated companies were

(1) Financial Statements of publicly held companies as shown in The Financial Post Survey of Industry various issues, adjusted.

for a variety of purposes and any attempt to reconcile them with the companies' relatively minor Canadian efforts is, at best, frustrating. It is best to regard all investments by these companies as being in the category of "direct" investment in Canadian subsidiaries or divisions. The only Canadian major investing heavily in Alberta during this period did raise funds in the bond market but also raised equity capital via a common stock issue and sold some producing subsidiaries during the period. It has been assumed that this source provided the funds for much of the company's development program, while the balance is treated as direct investment by an Eastern Canadian company in Alberta development.

Table 17 shows the estimated indebtedness incurred by the industry during the period 1947-52. Included as funded debt are small amounts for mortgages on office buildings and privately-raised loans. To present a more accurate picture of the amounts raised in this manner, the amount of debt reduced by conversion into equity investment through the exercise of conversion privileges is also noted.

Table 17

Funded Debt of Alberta's Petroleum Producing Industry 1947-52

(thousands of Dollars)

	1946	1947	1948	1949	1950	1951	1952
Outstanding debt (Dec. 31)							
Notes	-	-	-	500	16,650	16,675	16,467
Bonds	438	430	430	3,534	8,463	8,164	1,547
Debentures	1,262	1,163	888	4,602	26,752	33,965	51,786
Mortgages	-	-	-	-	-	1,071	900
Other loans	-	-	-	-	85	1,596	1,458
Total debt	1,700	1,593	1,318	8,636	51,950	61,471	72,158
Net Annual borrowing		(107)	(275)	7,318	43,314	9,521	10,687
Annual Conversion to Equity		-	-	-	126	12,343	7,712
Total raised by debt issues		(107)	(275)	7,318	43,440	21,864	18,399

( ) Denotes repayment.

for a variety of purposes ranging from mortgage loans to commercial relatively large Canadian firms to a few, insurance, if we have to regard all investments of this nature as being in the category of "direct" investment as Canadian corporations or nationals.

The only Canadian major securities issued in Alberta during this period did raise funds in the bond market but also raised equity capital via a common stock issue, and also some preferred stock during the period. It has been assumed that this source provided the funds for much of the company's development program, which the balance is treated as direct investment by an Alberta Canadian company in Alberta development.

Table 17 shows the estimated net-of-dollar issues made in the industry during the period 1947-62. Included as market debt are small amounts for mortgages on office buildings and miscellaneous loans. The material is more complete during the months related to this issues. The amount of debt retired by conversion into equity investment through the exercise of conversion privileges is also noted.

TABLE 17

Financial Data of Alberta's Exploration Producing Industry Issues

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Underlying Debt (Less.))						
Notes	-	-	-	500	10,000	10,475
Bonds	400	400	1,200	6,484	8,124	1,347
Debentures	1,300	1,177	600	4,475	25,725	25,028	21,198
Mortgages	-	-	-	-	-	1,071	400
Other Loans	-	-	-	-	80	1,300	1,[illegible]
Total Debt	1,700	1,577	1,[illegible]	4,[illegible]	43,[illegible]	41,421	35,[illegible]
Net Annual Borrowing	(400)	(400)	7,[illegible]	42,[illegible]	6,321	10,097
Annual Conversion to Equity	-	-	-	-	138	13,440	7,[illegible]
Total Issued by debt issues	(400)	(400)	7,[illegible]	42,[illegible]	21,[illegible]	18,[illegible]

( ) Denotes Conversion

As mentioned above, one Canadian major, Imperial Oil Limited, did a considerable portion of its financing by selling assets, particularly two subsidiaries, one foreign and one domestic. These two sales brought new capital into the industry and will be treated as such. Imperial sold other subsidiaries and certain fixed assets to two other operating companies. These sales did not affect industry totals, hence can be ignored in our analysis. Table 18 shows funds received through the sale of assets.

Table 18

Funds Received from Sale of Assets(2)

(Thousands of Dollars)

Details of Sale	1948	1949	1950	1951
Imperial Oil Ltd. - sale of International Petroleum Co. Ltd. to its shareholders	38,390	14,024	15,336	14,804
Imperial Oil Limited - Sale of Royalite Oil Company Ltd to Toronto underwriting group	-	14,784	-	-
	$38,390	28,808	15,336	14,804

Other forms of equity investment supplied the balance of the required funds. Table 19 shows the apparent extent of equity investment behind the expansion. The figures in this table were obtained by deducting estimates of funds from other sources (Tables 15-18) from estimated requirements (Table 14)

(2) Imperial Oil Limited, Annual Reports, 1948, 1949, 1950, Prospectus (S.E.C.) re share issue dated November, 16, 1951. 1951 figuresare estimated as the company published no statement of source and disposition of funds in 1951.

As mentioned above, one Canadian major, Imperial Oil Limited, did a considerable amount of the drilling for exploring companies, particularly the subsidiaries, the Canadian and the Canadian. These two sales brought one million into the company and additional revenue as well. Imperial and other subsidiaries and certain other companies or two other operating companies. These sales did not affect industry totals, hence can be ignored in our analysis. Table 15 shows total revenue through the sale of assets.

TABLE 15

Total Revenue from Sale of Assets

(Thousands of Dollars)

Details of Sale	1968	1969	1970	1971
Imperial Oil Ltd., sale of				
International Petroleum Co. Ltd.				
to its subsidiaries				
Imperial Oil (Algeria) - Sale of				
Royalite Oil Company Ltd.				
to Toronto Conservation group				

Other forms of equity investment complete the balance of the required funds. Table 16 shows the expected total of equity investment behind the industry. The figures in the table were obtained by deducting estimates of funds from other sources (Tables 14-18) from estimated requirements (Table 13).

(8) Imperial Oil Limited, [illegible] Petroleum Company [illegible] as share issue [illegible] Petroleum estimated to be company [illegible] in 1971.

Table 19

Apparent Equity Investment in Alberta's Petroleum Producing Industry
1947-52
(Thousands of Dollars)

1947	28,202
1948	25,393
1949	62,116
1950	57,842
1951	108,587
1952	145,491

Table 20 summarizes the ways in which funds were raised.

Table 20

Sources of Funds for the Alberta Petroleum Producing Industry
1947-52
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Sale of Products	20,284	37,597	61,692	85,539	118,953	141,738
Bank Loans	300	2,600	3,400	3,600	(600)	(4,200)
Bond Issues	(107)	(275)	7,318	43,314	9,521	10,687
Sale of other Assets	-	38,390	28,808	15,336	14,804	-
Equity Investment	28,202	25,393	62,116	57,842	108,587	145,491
Total	48,679	103,705	163,334	205,631	251,265	293,716

The apparent equity investment may be broken down still further, into that portion raised by sales of shares or conversion of bonds and a portion composed mainly of direct investment by parent firms. That portion of indebtedness converted to stock has been treated as a separate transaction, in which the bond is redeemed and the investor re-commits the funds in shares of the company. In many cases this is very close to what did happen, as companies gave notice of

Table 19

Apparent Equity Investment in Alberta Petroleum Producing Industry
1947-52
(Thousands of Dollars)

1947	38,203
1948	35,492
1949	53,119
1950	57,542
1951	108,327
1952	145,491

Table 20 summarizes the ways in which funds were raised.

Table 20

Sources of Funds for the Alberta Petroleum Producing Industry
1947-52
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Sale of Preferences	30,394	37,587	61,692	46,249	119,365	145,728
Bank Loans	300	3,000	5,400	3,000	(800)	(4,200)
Bond Issues	(100)	(372)	7,318	42,314	9,522	10,897
Sale of other Assets	-	39,390	28,805	15,388	14,804	-
Equity Investment	38,203	35,492	53,119	57,542	108,327	145,491
Total	68,897	105,705	165,334	206,493	251,218	298,916

The apparent equity investment may be broken down still further, into that portion raised by sales of shares or conversion of bonds and a portion acquired mainly of direct investment by parent firms. That portion of indebtedness converted to stock has been treated as a separate transaction, in which the bond is redeemed and the investor re-invests the funds in shares of the company. In many cases this is very close to what did happen, as companies gave notice of

redemption of convertible issues, hastening their conversion. For this reason, conversions were deducted from borrowings in Table 17 to give a net picture. They are included in Table 21's tabulation of equity investments.

Table 21 lists equity investments by types for the years under review. In this tabulation, the total for share issues was obtained by a study of available financial statistics for over 400 publicly held companies which were active in Alberta during this period. Adjustments were made for investment elsewhere by these companies and it is believed that the resulting figures present as accurate a picture as is possible of the equity funds committed to oil production in Alberta by this group of companies during the years under discussion. The amount of conversions mentioned in the last paragraph

Table 21.

Apparent Sources of Equity Financing- Alberta Petroleum Producing Industry.

1947-52

(thousands of Dollars)

	1947	1948	1949	1950	1951	1952
New Share Issues	4,853	5,211	20,499	53,414	55,410	80,312
Converted Bonds	--	--	--	126	12,343	7,712
Residual	23,349	20,182	41,617	4,302	40,834	57,467
	28,202	25,393	62,116	57,842	108,587	145,491

is also shown. The balance is a residual derived from the earlier residual for total equity investment (see Table 19) and is the least reliable estimate for any source of cash. This residual has at least five components, including the following, in estimated order of importance.

(1) Direct investment by foreign parent companies, principally

redemption of convertible assets, deducting such conversion. For this reason, conversions were deducted from subscriptions in Table 17 to give a net picture. They are included in Table 17a indication of equity investments.

Table 17 lists equity investments by types for the years under review. In this situation, the total for these years was obtained by a study of available financial statistics for over 100 publicly held companies which were active in Alberta during this period. Adjustments were made for intercorporate investments by these companies and it is believed that the resulting figures present an accurate picture as to position of the equity funds committed to oil production in Alberta by these group of companies during the first seven years of operation. The amount of conversions deducted in the last paragraph appears in Table 17a.

Table 17.

Aggregate Sources of Funds, Producing Alberta Companies, 1947 to 1953 inclusive.

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
New Share Issues	3,812	8,321	27,490	14,814	46,410	70,324
Converted Bonds	—	—	—	124	16,847	7,174
Retained	24,728	39,193	41,417	4,312	40,884	57,447
	28,540	47,514	67,114	19,242	104,141	134,945

is also shown. The balance is a residual derived from the yearlies residual for total equity investment (see Table 18a) and is the least reliable estimate for any source of funds. This personal has at least five components, including the following, in descending order of importance.

(1) Direct investment by foreign parent companies, principally

U.S. owned.

(2) Direct investment by Canadian integrated companies, not accounted for above.

(3) Investment by privately-held companies and by individuals, believed to be slight.

(4) Deep test well credits allowed by the Federal Government as a credit against taxes payable. These may be regarded as a form of exploratory expenditure by the Federal Government, and were not provided for in the income tax estimates of Chapter 2.

(5) Involuntary equity contributions made by the creditors of a handful of bankrupt companies.

It will be noted that the residual item drops very low in 1950. This may be due to most foreign investment that year being channelled into pipeline construction, as well as to an underestimate of the increase in working capital. The tremendous upsurge in share issues and bond issues during the year suggeststhat working capital did, in fact, increase substantially more than the $19 million estimated.

For the sake of comparison, Table 22 presents D.B.S. statistics on the extent of U.S. direct investment in all phases of the industry.

Table 22

U.S. "Direct" Investment vs "Residual" Investment

(Thousands of Dollars)

	U.S. Direct Investment in Entire Petroleum Industry (3)	"Residual" Investment
1947	12,000	23,349
1948	23,000	20,182
1949	59,000	41,617
1950	116,000	4,302
1951	140,000	40,834
1952	178,000	57,467

(3) Includes Production, Exploration, Refining, Marketing, and Transportation for all Canada, Source : D.B.S. "Canada's Balance of International Payments, 1955. Ottawa, 1956. Statement 12, p. 18

It remains to determine the geographical source of the funds raised. The source of funds received from the sale of products was calculated on the basis of product disposition statistics published by the Petroleum and Natural Gas Conservation Board and is shown in Table 23.

Table 23

Geographic Sources of Funds from the Sale of Products (4)

1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Sector III (Alberta)	17,315	27,489	37,622	49,123	43,786	48,533
Sector IV(Rest of Canada)	2,969	10,108	24,070	36,416	74,031	90,578
Sector V(Rest of World)	-	-	-	-	1,136	2,627
Total	20,284	37,597	61,692	85,539	118,953	141,738

As all of the prairie provinces generate a surplus of loanable funds within the chartered banks, it is safe to assume that bank loans to the industry were financed entirely from savings arising within the province.

In raising funds for exploration and development through the sale of bonds, Canadian independent companies have been forced to rely to a considerable extent on the Canadian bond market. The expense of S.E.C. registration and the unfamiliarity of the American bond-buying public with Canadian oil producers of merit were no doubt strong contributing factors. A careful search indicates only four bond issues sold in the U.S. by Alberta independents during this period, all of which were placed with institutional buyers. There have been a great many more since 1952, and no doubt a good many "second-hand"

(4) Conservation Board Alberta Oil Industry, annual volumes, 1947-52

[illegible] It remains to determine the geographical source of the funds raised. The course of bond prices, [illegible] the sale of securities was calculated on the basis of general [illegible] statistics published [illegible] by the Petroleum and Natural Gas Conservation Board and is shown in Table 26.

Table 26

Geographic Source of Funds from the Sale of Securities (1)

1947-48

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Source UK (Alberta)	17,914	27,876	37,844	61,130	44,746	46,440
Source Ontario (Province of Canada)	5,001	10,746	24,370	16,417	7,051	20,875
Source Yukon Vet. Wound	-	-	-	-	1,196	3,321
Total	22,914	37,587	62,214	77,547	53,993	110,636

As 44% of the provincial revenue represents a surplus of non-taxable funds within the Alberta bond market, it is safe to assume that bonds issued in the industry were financed entirely from revenue arising within the province.

In relating funds for exploration and development through the sale of bonds, Canadian institutional investors have been forced to rely to a considerable extent on the Canadian bond market. The response of S.E.C. representatives and the underwriting of the American bond-buying public with Canadian oil prospects of merit were no doubt strong contributing factors. A special analysis indicates that the bond issues sold in the U.S. by Alberta independents during this period, all of which were placed with institutional investors, [illegible] have been a great deal more since 1950, and no doubt a good many "[illegible]"

(1) Conservation Board Bulletin [illegible], annual volumes, 1947-48

bonds have crossed the border. Sales of new bond issues in the U.S. by Alberta producers totalled $8,699,000 in 1950 and $1,723,000 in 1952.

Splitting the balance of the bond issues between Alberta and the rest of Canada is a more difficult task. Nearly all the underwriting was done by Toronto bond houses and a large portion was taken by institutional buyers including banks and insurance companies. An arbitrary allowance of ten percent was made to allow for those bonds held directly or indirectly by Albertans. Table 24 indicates the estimated sources of borrowed funds.

Table 24.

Geographic Sources of Borrowed Funds - 1947 - 1952

(exclusive of bank borrowing)

(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Net Bond Issues.
1947	(10)	(97)	-	(107)
1948	(27)	(248)	-	(275)
1949	731	6,587	-	7,318
1950	3,462	31,153	8,699	43,314
1951	952	8,569	-	9,521
1952	896	8,068	1,723	10,687

Sources of the funds raised by the sale of assets can be more accurately determined. Two such sales took place. The first involved the sale by Imperial Oil Limited of its former South American subsidiary, International Petroleum Co. Ltd. to its shareholders following an issue of rights in 1948. As almost 70% of Imperial's stock is owned by the Standard Oil Company (N.J.) and private American holdings probably account for another 10%, it appears likely that at least 80% of the

funds have crossed the border. Sales of gas have been heavy in the U.S., by Alberta producers totalling $44,000,000 in 1960 and $129,000,000 in 1962.

Shifting the balance of the food issue, both Alberta and the rest of Canada is a more difficult task. Nearly all transportation was done by Toronto food houses and a large portion was taken by institutional buyers including banks and insurance companies. An arbitrary allowance of ten percent was made to allow for those funds paid directly or indirectly by Alberta. Table 24 indicates the principal sources of borrowed funds.

Table 24.

Geographic Sources of Borrowed Funds - 1947 to 1962

(estimates of bank borrowing)

(Thousands of Dollars)

	Source III (Alberta)	Source IV (Rest of Canada)	Source V (Rest of World)	Net Bond Issues
1947	[illegible]	487	-	(107)
1948	[illegible]	(348)	-	(276)
1949	[illegible]	8,647	-	7,813
1950	[illegible]	23,135	[illegible]	[illegible]
1951	[illegible]	1,265	-	2,881
1952	992	8,048	1,768	10,847

Sources of the funds raised by the sale of assets can be more accurately determined. Two such sales took place. The first involved the sale by Canadian Oil Limited of its former South American subsidiary, International Petroleum Co. Ltd. to its shareholders (Canadian issue of rights in 1959. As almost 70% of Imperial's stock is owned by the Standard Oil Company (N.J.) and private American holdings probably remain low as another 10%, it appears likely that at least 80% of the

funds raised by this transaction came from the United States. Of the remaining 20% of funds, it was assumed that 10% (or 2% of the total) came from Alberta.

The second sale was that of the former Alberta producing subsidiary, Royalite Oil Co. Ltd. Through a Toronto underwriting group in 1949. It was also assumed that 10% of this stock was bought in Alberta. Table 25 summarizes the geographical pattern of this source of financing.

Table 25

Geographic Sources of Funds Obtained by Sale of Assets

1947-52

(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Total Sales
1948	768	6,910	30,712	38,390
1949	1,758	15,831	11,219	28,808
1950	307	2,760	12,269	15,336
1951	296	2,665	11,843	14,804

An attempt has been made to trace the source of equity funds in a similar manner. Table 26 analyses the source of funds from new stock issues. These were estimated from actual data appearing in the Financial Posts "Survey of Oils". In this instance, the extent of U.S. ownership is understated since many securities issued originally in Canada were acquired later by American and other foreign investors. Data in the table relate to new issues only as determined from details of underwriting houses, etc. No attempt is made to account for actual ownership, as determined by subsequent purchases and sales.

funds raised by the Transcontinental United National Bank. Of the remaining 80% of funds, it was estimated that 10% (or 20% of our total) came from Alberta.

The second sale was also in the Province Alberta province subsidiary, Royalite Oil Co. Ltd. The sale was successful again in 1949. It was also assumed that 10% of this stock was bought in Alberta. Table 22 summarizes the proportional nature of this source of financing.

Table 22.

Geographic Sources of Funds Obtained by Sale of Stock

1947-51

(Thousands of Dollars)

	Sales in Alberta	Sales in Other Provinces	Sales in U.S.	Total Sales
1947	[illegible]	[illegible]	[illegible]	[illegible]
1948	[illegible]	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	[illegible]

An attempt has been made to trace the control of equity funds in a similar manner. Table 23 summarizes the control of funds from the stock issues. These were collected from annual and prospectus in the Financial Post "Survey of Oils". In this instance, the extent of U.S. ownership is underestimated since many securities issued originally in Canada were acquired later by American and other foreign investors. Data in the table relate to new issues only as determined from annual of Aspectrition Bonds, Inc. No attempt is made to trace to "final" ownership, as determined by subsequent purchases and sales.

Table 26

Geographic Pattern of Stock Issues: 1947-52
(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Total
1947	1,514	2,014	1,325	4,853
1948	1,818	3,018	375	5,211
1949	2,813	10,013	7,673	20,499
1950	4,917	24,018	24,479	53,414
1951	7,056	31,056	17,298	55,410
1952	11,092	44,367	24,853	80,312

Analysis of the debenture issues converted revealed that only one of the converted issues was held in the U.S., conversions in this case totalling $234,000 in 1952. The balance were Canadian-held and were assumed to be split 10% in Alberta and 90% in other provinces.

"Residual" investment, including direct investment by foreign and eastern firms, private companies, tax credits and liabilities of bankrupt firms (5) has been divided between Sectors as shown in Table 27. The basis for this allocation is an estimate of U.S. direct investment from the balance of payments statistics (6).

Table 27

Geographic Source of "Residual" Investment: 1947-52
(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Total
1947	2,349	10,000	11,000	23,349
1948	1,500	6,682	12,000	20,182
1949	1,617	10,000	30,000	41,617
1950	1,500	8,000	(4,698)	4,302
1951	834	10,000	30,000	40,834
1952	1,467	11,000	45,000	57,467

Table 28 summarizes the geographic sources of funds received by the industry.

(5) Cf. supra pp.38-39

(6) D.B.S. Canada's Balance of International Payments, 1955, Ottawa, 1956, p.18 ff.

Table 26

Geographic Shares on Some Issues, 1947-52
(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Total
1947	1,814	3,044	1,346	6,204
1948	1,964	3,018	378	6,211
1949	2,447	10,072	7,275	20,094
1950	4,942	14,018	24,272	43,232
1951	7,068	21,018	17,298	45,114
1952	11,041	14,357	21,499	46,797

Analysis of the debentures issues converted reveals that only one of the converted issues was held in the U.S., conversions in this year totaling $234,000 in 1952. The balance were Canadian-held and were accounted for in split 10% in Alberta and 90% in other provinces.

Residual investment, including direct investment by foreign and eastern firms, private companies, tax credits and liabilities of banking firms (9) has been divided between Sectors as shown in Table 27. The basis for this allocation is an estimate of U.S. direct investment from the balance of payments statistics (8).

Table 27

Geographic Shares of Residual Investment 1947-52
(Thousands of Dollars)

	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)	Total
1947	3,446	10,000	17,000	30,446
1948	1,900	6,282	13,000	20,182
1949	1,817	16,000	20,000	37,817
1950	1,000	8,000	(4,000)	5,000
1951	234	10,000	20,000	30,234
1952	1,167	11,000	20,000	32,167

Table 28 summarizes the geographic sources of funds, particularly the industry.

(8) Cf. supra pp. 32-34

(9) D.B.S. Canada's Balance of International Indebtedness, 1952. Ottawa 1953, p.18 ff.

Table 28

Geographic Analysis Of Source of Funds

1947-52

Thousands of Dollars

	1947	1948	1949	1950	1951	1952
Sector III (Alberta)	21,468	34,148	47,941	62,922	53,558	58,536
Sector IV Rest of Canada)	14,886	26,470	66,501	102,460	137,430	160,743
Sector V (Rest of World)	12,325	43,087	48,892	40,249	60,277	74,437
Total Funds Received	48,679	103,705	163,334	205,631	251,265	293,716

(5) Cf. supra pp. 38-39
(6) D.B.S. Canada's Balance of International Payments 1955, Ottawa 1956 p. 18ff

Table 16

Geographic Analysis Of Source Of Funds

1947-62

Thousands of Dollars

	1947	1948	1949	1950	1951	1952
Sector III (Alberta)	21,474	34,144	47,041	62,822	63,555	[illegible]
Sector IV (East of Canada)	14,886	26,470	38,302	147,144	157,450	160,[illegible]
Sector V (Rest of World)	12,319	19,027	34,402	40,219	60,277	74,607
Total Funds Received	48,679	105,706	108,[illegible]	[illegible]	381,282	382,[illegible]

(8) Cf. supra pp.38-39

(9) D.B.S. Canada's Balance of International Payments 1952. Ottawa 1956 p. 147

CHAPTER 5

The Service Company Account (Sector II)

This Chapter presents expenditure estimates for the large group of companies engaged in miscellaneous activities which have been previously classified as "service companies". Payments to these companies, aggregated in Sector II in the analysis of Chapter 3, are now allocated to the other Sectors, along with estimated capital expenditures by the companies. Data on sources of funds are also presented.

Firms in this category include the following:

Geophysical Contractors

Drilling Contractors

Well cementing, testing and servicing companies

Geological, geophysical, engineering and management consultants

General contractors engaged in oilfield construction

Investors owning office buildings occupied by oil companies

This group includes not only separate firms as listed above, but geophysical, drilling and real estate departments of integrated companies which operate their own seismic crews or drilling rigs or own their own office buildings.

Table 29 presents income data for Sector II companies, outlining the services for which payment was received.

TABLE 29

Income Account - Sector II Companies
1947-52
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Geophysical Contractors	2,772	7,830	17,775	22,480	33,375	37,060
Drilling Contractors	6,257	11,240	22,794	30,696	39,436	47,080
Structure Test Drillers	72	492	972	2,532	4,514	4,560
Well cementing, testing, acidizing, logging, perforating, workovers, etc.	3,895	6,926	13,965	18,840	24,933	30,024
Oilfield Construction	715	1,195	4,300	4,879	4,460	5,500
Office Rentals	400	600	900	1,200	1,600	2,000
Total Cash Income	14,111	28,293	60,706	80,627	107,328	126,224

Operating expenses of this group have been estimated as shown in Table 30. Very briefly, the method employed was to estimate operating expenses for each class of firms on the basis of available data. These were in turn analyzed to determine their geographical allocation. Some remarks should be made at this point concerning the treatment of depreciation. All non-cash charges were expressly excluded from consideration in our analysis of Sector I expenditures. However, the cash expenditures by Sector I, which become revenue to Sector II, also cover non-cash expense items of the Sector II companies. Thus, while depreciation is a non-cash item for service companies, it is a cash outflow for operators, and cash must be found from some source to meet this requirement. It should also be noted that while depreciation is a source of funds for Sector II companies, the "geographic" source is Sector I, and it may be more easily regarded as a

TABLE 39

Income Account - Sector II Companies
1947-52
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Geophysical Contractors	4,772	7,250	17,715	24,450	36,116	37,080
Drilling Contractors	6,267	11,240	12,764	30,087	38,456	47,080
Structure Test Drillers	72	402	872	2,832	4,814	4,880
Well cementing, testing, acidizing, logging, perforating, workovers, etc.	3,880	6,424	13,885	18,840	24,885	30,024
Oilfield Construction	718	1,180	4,300	4,678	4,880	6,800
Office Rentals	400	380	900	1,380	1,800	2,000
Total Cash Income	14,111	28,881	50,106	80,027	107,345	126,824

Operating expenses of this group have been estimated as shown in Table 39. Very briefly, the method employed was to estimate operating expenses for each class of firms on the basis of available data. These were in turn analyzed to determine their geographical allocation. Some remarks should be made at this point concerning the treatment of depreciation. All non-cash charges were expressly excluded from consideration in our analysis of Sector I expenditures. However, the cash expenditures by Sector I, which become revenue to Sector II, also cover non-cash expense items of the Sector II companies. Thus, while depreciation is a non-cash item for service companies, it is a cash outflow for operators, and cash must be found from some source to meet this requirement. It should also be noted that while depreciation is a source of funds for Sector II companies, the "geographic" source is Sector I, and it may be more easily regarded as a

non-expenditure of cash received. To include it as a separate source of funds would involve a double-counting of this amount, as it is not raised from outside the industry and the required amount has already been accounted for in analyzing the sources of funds for Sector I.

A detailed discussion of the methods used in estimating and allocating both sources and expenditures of funds by Sector II companies may be found in the Appendix to Chapter 5.

TABLE 30

Operating Expenses - Sector II Companies
1947-52
(thousands of dollars)

Cash Operating*

	1947	1948	1949	1950	1951	1952
Sector III	8,272	16,506	35,419	47,688	61,442	73,122
Sector IV	2,087	4,332	8,655	10,346	16,818	19,414
Sector V	2,730	5,312	11,597	15,480	19,775	22,400
Total Cash	13,089	26,150	55,671	73,514	98,035	114,936
Depreciation	1,022	2,143	5,035	7,113	9,293	11,288
Total	14,111	28,293	60,706	80,627	107,328	126,224

* Including Dividends

non-expenditure of cash involved. To include it as a separate source of funds would involve a double counting of this amount, and it is not raised from outside the industry and the required amount has already been accounted for in analyzing the sources of funds for Sector I.

A detailed description of the methods used in estimating and allocating both sources and expenditures of funds by Sector II companies may be found in the Appendix to Chapter 8.

TABLE 52

Operating Expenses - Sector II Companies
1947-52
(thousands of dollars)

Cash Operating*

	1947	1948	1949	1950	1951	1952
Sector III	8,872	18,500	32,412	41,884	61,442	73,424
Sector IV	2,887	4,328	6,665	10,948	12,028	16,114
Sector V	2,240	3,314	11,207	15,480	15,715	24,600
Total Cash	13,999	26,180	50,271	68,312	89,085	114,038
Depreciation	1,022	2,148	6,355	7,114	9,328	11,386
Total	14,111	28,328	56,626	80,827	107,488	125,424

* Including Dividends

Capital Expenditures by this group of companies are estimated in Table 31. Imports of specialized equipment by this group represent one of the largest cash flows to Sector V, as during this period virtually all special oilfield equipment was imported.

TABLE 31

Capital Expenditures - Sector II Companies
1947-52
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Sector III	525	1,690	1,733	2,121	3,315	2,457
Sector IV	408	1,692	2,123	1,844	3,365	(1,406)*
Sector V	3,562	5,909	3,904	8,137	11,555	5,614
	4,495	9,291	7,760	12,102	18,235	6,665

Table 32 summarizes geographic sources of funds for this group. Additional requirements were met from depreciation as noted above.

TABLE 32

Geographic Sources of Funds - Sector II Companies
1947-52
(thousands of dollars)

	1947	1948	1949	1950	1951	1952
Sector III	2,110	4,081	2,597	4,752	5,548	(3,010)*
Sector IV	(42)*	637	955	924	1,232	920
Sector V	2,061	4,487	2,654	3,362	4,877	11,288
	4,129	9,205	6,206	9,038	11,657	9,198

* Brackets, thus, (), indicate net negative quantities. In Table 31 these result from an export of capital; in Table 32 from movement of funds out of the province.

Capital Expenditures by this group of companies in Sector IV, Table 31, imports of capital equipment from this group of companies was the largest, as shown in Table 32, during this period covering all capital, skilled equipment and imports.

TABLE 32

Capital Expenditures - Sector IV Companies
1947-53
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953
Sector IV	738	4,980	1,758	3,181	8,718	3,447	
Sector IV	498	1,002	4,324	1,147	7,324	14,000*	
Region I	4,454	5,894	5,894	5,132	11,414	5,124	
	4,492	1,291	13,142	13,142	11,324	5,000	

Table 33 summarizes production sources of funds for this group. Additional requirements were met from capital imports as noted above.

TABLE 33

Capital Sources of Funds - Sector IV Companies
1947-53
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953
Sector IV	3,120	4,981	4,347	6,182	7,846	6,414*	
Sector IV	(419)	847	984	124	1,324	1,124	
Sector V	3,081	1,487	3,384	3,582	4,874	11,000	
	4,178	3,305	6,400	9,588	11,324	5,184	

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*Probably, some, if, indicate accounting adjustments. In Table 31 these result from an export of capital; in Table 32 from movement of funds out of the province.

CHAPTER 6

This study, up to this point, has been concerned with the details of sector-by-sector estimates of receipts and expenditures. Interpretation of such estimates has been avoided. It is now time to bring the estimates together so as to construct a unified picture to see what tentative conclusions, if any, are discernible from them.

Tables 33 to 38 are consolidating tables. They bring together the estimates that have been made, and present at a glance the pattern of cash flows from sector to sector, year by year.

A number of inferences can be drawn from these tables, some directly, some after further analysis. An obvious inference is, of course, the extent to which the industry grew during this period. As indicated in Chapter 1 (1) for a pioneer period such as that under review, expenditures give a more accurate picture of growth than production statistics, owing to the extent capital expenditures do not reflect themselves immediately in production increases. During the 1947-1952 period, annual expenditures by the industry grew from $33,296,000 to $272,809,000, an increase of approximately 700 percent in in six years. The organizational and administrative problems involved in growth at this rate are of a nature seldom found outside of a total war economy. Such growth would have been impossible without imports of capital, specialized equipment and skilled technical personnel. The level of apparent efficiency maintained during the expansion, as illustrated by the industry's cost experience, is a tribute not only to the flexibility of private enterprise but to the foresight of government officials responsible for regulation of the industry. Mistakes were made but they were of a minor nature in comparison with the enormity

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(1) Cf. page 1 supra.

[illegible]

This study, as in most cases, has been concerned with the difficult subject of by-product estimates of resource expenditures. Injury statistics of such large [illegible] magnitude have been avoided. It is not worthwhile trying to estimate logistics [illegible] to construct a unified country [illegible] identify [illegible] discernible from them.

Tables 32 to 38 are noncomparable series. They bring together the estimates that have been made, and present at a glance the pattern of cash flows from period to period, year by year.

A number of differences can be drawn from these tables, some obvious, some other by further analysis. An obvious difference is, of course, the extent to which the industry grew during this period. As indicated in Chapter V (1), the a pioneer period such as that under review, necessitates give a more accurate picture of growth than [illegible] relationship, owing to the almost capital expenditures as not reflect productive industry's production increases. During the 1941-1952 period, capital expenditures by the industry grew from 35,196,000 to 3,272,000, an increase of approximately 700 percent in six years. The organizational and administrative problems involved in growth at this rate are of a nature seldom found outside of a total war economy. Such growth would have been impossible without imports of capital, special [illegible] equipment and skilled technical personnel. The level of apparent efficiency maintained during the expansion, as illustrated by the industry's [illegible] is a tribute not only to the flexibility of private enterprise but to the [illegible] of government officials responsible for expansion of the industry. Mistakes were made but they were of a minor nature in comparison with the amount

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(1) Cf. page 1 supra.

of the problems faced. However, an analysis of the administration of the government's regulatory policies or of the competitive structure of the industry is beyond the scope of this thesis.

TABLE 33

Summary of Inter-Sectoral Transactions - 1947
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(9,925)	6,548	1,758	726	893
Development	(10,007)	6,741	754	59	2,453
Operating	(2,950)	422	2,106	232	190
Administration & Overhead	(2,288)	400	1,185	140	563
Royalties	(1,663)	-	1,079	357	227
Financial	(3,620)	-	795	2,610	215
Sub Total	(30,453)	14,111	7,677	4,124	4,541
Service Companies					
Operating		(13,089)	8,272	2,087	2,730
Capital		(4,495)	525	408	3,562
Total Expenditures	(30,453)	(3,473)	16,474	6,619	10,833
B. Working Capital Increases	(18,226)	(656)			
	(48,679)	(4,129)			
C. Sources of Funds					
(a) Current					
Sale of Products	20,284	-	(17,315)	(2,969)	-
(b) Capital					
Bank Loans	300	-	(300)	-	-
Bonds	(107)	-	10	97	-
Sale of Assets	-	-	-	-	-
Stock Issues	4,853	-	(1,514)	(2,014)	(1,325)
Converted Bonds	-	-	-	-	-
Residual	23,349	-	(2,349)	(10,000)	(11,000)
Service Cos.	-	4,129	(2,110)	42	(2,061)
Total Capital	28,395	4,129	(6,263)	(11,875)	(14,386)
Total Receipts	48,679	4,129	(23,578)	(14,844)	(14,386)

Total Expenditures, Sector I and Sector II - $33,926,000

EXHIBIT XV

Summary of Operating Budget Comparisons - 1947
(Thousands of Dollars)

	Source			
	II.	III.	IV.	V.
	(Checkerboard Service Center Cost.)	(Alberta Cost.)	(Head of Canada Cost.)	(Total of Month.)
A. Expenditures				
Expedition	(6,889)	6,449	3,182	704
Overhauling	(30,097)	6,341	104	26
Operating	(2,107)	342	2,476	270
Administration & Overhead	(3,184)	844	1,165	142
Supplies	(3,963)	-	1,074	847
Training	(3,889)	-	196	2,610
Sub Total	(48,243)	14,111	7,197	4,134
Service Centre Cost				
Operating	(1,000)	2,477	4,087	2,130
Capital	(2,000)	300	400	3,300
Total Expenditures	(51,243)	16,878	15,684	9,564
B. Working Capital Increase	(19,000)	(800)		
	(32,243)	(16,078)		
C. Sources of Funds				
(a) Current				
Sale of Products	20,294	-	(17,010)	(2,388)
(b) Capital				
Term Loans	500	-	(400)	-
Stocks	(107)	-	10	97
Sale of Assets	-	-	-	-
Stock Issue	4,403	-	(1,014)	(2,010)
Consolidated				
Gain	-	-	-	-
Reliance	21,344	-	(2,300)	(10,000)
Service Cos.	-	(1,170)	(1,120)	30
Total Capital	26,140	(1,170)	(2,024)	(12,278)
Total Sources	46,434	(1,170)	(19,034)	(14,666)

Total Expenditures, Source I and Source II - $32,243,000

TABLE 34

Summary of Inter-Sectoral Transactions - 1948
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(30,611)	15,071	12,895	982	1,663
Development	(18,375)	11,927	1,395	134	4,919
Operating	(4,320)	695	2,985	327	313
Administration & Overhead	(5,331)	600	2,690	408	1,633
Royalties	(3,558)	-	2,338	760	460
Financial	(4,709)	-	877	3,504	328
Sub Total	(66,904)	28,293	23,180	6,115	9,316
Service Companies					
Operating	-	(26,150)	16,506	4,332	5,312
Capital	-	(9,291)	1,690	1,692	5,909
Total Expenditures	(66,904)	(7,148)	41,376	12,139	20,537
B. Working Capital Increases	(36,801)	(2,057)			
	(103,705)	(9,205)			
C. Sources of Funds					
(a) Current					
Sale of Products	37,597	-	(27,489)	(10,108)	-
(b) Capital					
Bank Loans	2,600	-	(2,600)	-	-
Bonds	(275)	-	27	248	-
Sale of Assets	38,390	-	(768)	(6,910)	(30,712)
Stock Issues	5,211	-	(1,818)	(3,018)	(375)
Converted Bonds	-	-	-	-	-
Residual	20,182	-	(1,500)	(6,682)	(12,000)
Service Cos.	-	9,205	(4,081)	(637)	(4,487)
Total Capital	66,208	9,205	(10,740)	(16,999)	(47,574)
Total Receipts	103,705	9,205	(38,229)	(27,107)	(47,574)

Total Expenditures, Sector I and Sector II - $74,052,000

Table 14

SUMMARY OF [illegible] Financing - 1963
(Thousands of Dollars)

	Section			
	(1)		(2)	
	(Previous) Section 1 (Sec. 3)		(Adjusted) Section 1 (Sec. 3)	(Adjusted) Section 2 (Sec. 4)
A. Expenditures				
Exploration	(16,811)	15,575	10,896	800
Development	(15,475)	11,891	2,000	320
Operating	(1,279)	800	2,876	277
Administration &				
Overhead	(5,191)	500	2,500	100
Royalties	(3,550)	-	2,229	700
Financial	(1,100)	-	500	200
Sub Total	(38,356)	28,266	17,100	1,377
Service Expenditures				
Operating	-	(26,190)	16,800	1,171
Capital	-	(2,077)	1,000	206
Total Expenditures	(38,356)	1,976	17,100	1,377
B. Working Capital				
Increase	(38,356)	2,276		
	(100.00)	2.00		
C. Receipts of Funds				
(a) Current				
Sale of Products	32,300	-	(27,800)	(17,100)
(b) Capital				
Bank Loans	2,000	-	(2,000)	-
Bonds	(200)	-	77	248
Sale of Assets	32,240	-	(240)	(4,000)
Stock Issues	4,311	-	(4,000)	(3,000)
Conversion Bonds	-	-	-	-
Residual	24,125	-	(1,800)	(10,000)
Service Cos.	-	2,155	(1,000)	(247)
Total Capital	38,876	2,155	(10,140)	(17,295)
Total Receipts	103,176	2,155	(38,320)	(1,805)

Total Expenditures, Section 1 and Section 2 = $19,102,600

TABLE 35

Summary of Inter-Sectoral Transactions - 1949
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(67,486)	30,668	32,630	1,263	2,925
Development	(42,902)	27,829	3,142	334	11,597
Operating	(7,391)	1,309	4,950	543	589
Administration & Overhead	(11,778)	900	6,600	855	3,423
Royalties	(6,204)	-	4,402	1,116	686
Financial	(4,744)	-	749	3,616	379
Sub Total	(140,505)	60,706	52,473	7,727	19,599
Service Companies					
Operating		(55,671)	35,419	8,655	11,597
Capital		(7,760)	1,733	2,123	3,904
Total Expenditures	(140,505)	(2,725)	89,625	18,505	35,100
B. Working Capital Increases	(22,829)	(3,481)			
	(163,334)	(6,206)			
C. Sources of Funds					
(a) Current					
Sale of Products	61,692	-	(37,622)	(24,070)	-
(b) Capital					
Bank Loans	3,400	-	(3,400)	-	-
Bonds	7,318	-	731	(6,587)	-
Sale of Assets	28,808	-	(1,758)	(15,831)	(11,219)
Stock Issues	20,499	-	(2,813)	(10,013)	(7,673)
Converted Bonds	-	-	-	-	-
Residual	41,617	-	1,617	(10,000)	(30,000)
Service Cos.	-	6,206	(2,597)	(955)	(2,654)
Total Capital	101,642	6,206	(12,916)	(43,386)	(51,546)
Total Receipts	163,334	6,206	(50,538)	(67,456)	(51,546)

Total Expenditures, Sector I and Sector II - $143,230,000

TABLE 32

Summary of Inter-Sectoral Transactions - 1960
(Thousands of Cruzeiros)

	Sector				
	I	II	III	IV	V
	(Industry)	(Agriculture)	(Service Cos.)	(Heat of Cattle)	(Beans of "Carioca")
A. Expenditures					
Implementation	(67,486)	30,306	32,650	1,265	2,405
Development	(42,029)	27,278	3,182	234	11,827
Operating	(7,271)	1,006	2,850	845	262
Administration &					
Overhead	(11,776)	900	2,800	285	2,415
Royalties	(2,304)	-	4,420	1,115	898
Financial	(4,724)	-	780	1,216	272
Sub Total	(132,590)	59,788	52,272	7,762	18,589
Service Companies					
Operating	(28,271)	25,212	3,252		11,287
Capital	(2,180)	(180)	2,180	1,188	3,884
Total Expenditures	(160,361)	(2,780)	55,698	18,205	33,760
B. Working Capital					
Increases	(22,822)	(2,181)			
	(183,183)	(4,961)			
C. Sources of Funds					
(a) Current					
Sale of Products	31,270	-	32,208	(24,370)	-
(b) Capital					
Bank Loans	2,440	-	(2,100)	-	-
Bonds	7,316	-	781	(6,887)	-
Sale of Assets	26,300	-	(1,780)	(21,421)	(11,278)
Stock Issue	20,302	-	(2,328)	(10,010)	(7,674)
Convertor Bonds	-	-	-	-	-
Residual	41,817	-	1,617	(16,000)	(30,000)
Service Cos.	-	2,320	(2,320)	(455)	(2,034)
Total Capital	101,022	2,320	(2,810)	(49,394)	(4,448)
Total Receipts	164,324	2,108	(50,524)	(92,434)	(31,148)

Total Expenditures, Sector I and Sector II - $114,230,000

TABLE 36

Summary of Inter-Sectoral Transactions - 1950
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(83,311)	37,306	41,502	1,447	3,056
Development	(62,926)	40,324	4,723	409	17,380
Operating	(9,947)	1,797	6,616	725	809
Administration & Overhead	(15,618)	1,200	8,920	1,099	4,399
Royalties	(7,358)	-	5,550	1,194	614
Financial	(7,004)	-	856	5,388	760
Sub Total	(186,164)	80,627	68,167	10,352	27,018
Service Companies					
Operating	-	(73,514)	47,688	10,346	15,480
Capital	-	(12,102)	2,121	1,844	8,137
Total Expenditures	(186,164)	(4,989)	117,976	22,542	50,635
B. Working Capital Increases	(19,467)	(4,059)			
	(205,631)	(9,048)			
C. Sources of Funds					
(a) Current					
Sale of Products	85,539	-	(49,123)	(36,416)	-
(b) Capital					
Bank Loans	3,600	-	(3,600)	-	-
Bonds	43,314	-	(3,462)	(31,153)	(8,699)
Sale of Assets	15,336	-	(307)	(2,760)	(12,269)
Stock Issues	53,414	-	(4,917)	(24,018)	(24,479)
Converted Bonds	126	-	(13)	(113)	-
Residual	4,302	-	(1,500)	(8,000)	4,698
Service Cos.	-	9,048	(4,762)	(924)	(3,362)
Total Capital	120,092	9,048	(18,561)	(66,968)	(43,611)
Total Receipts	205,631	9,048	(67,684)	(103,384)	(43,611)

Total Expenditures, Sector I and Sector II - $191,153,000

Table 29

Summary of Inter-Sectoral Transactions - 1960

(Thousands in Dollars)

	Sector I (Petroleum Cos.)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
A. Expenditures					
Exploration	(85,311)	37,206	41,502	1,447	3,055
Development	(68,954)	40,224	4,125	499	17,980
Operating	(6,447)	1,127	5,418	785	809
Administration &					
Overhead	(16,818)	1,240	8,880	1,006	4,389
Royalties	(7,848)	-	5,350	1,165	814
Taxes	(7,204)	-	494	5,825	785
Sub Total	(186,607)	80,797	60,167	10,326	27,832
Service Companies					
Operating	-	(78,316)	47,088	10,242	16,480
Capital	-	(7,260)	3,121	1,844	8,197
Total Expenditures	(186,607)	(4,519)	111,376	22,412	52,509
B. Working Capital					
Increases	(10,827)	(4,059)			
	(200,834)	(8,578)			
C. Sources of Funds					
(a) Current					
Sale of Products	8,499	-	(93,128)	(36,416)	-
(b) Capital					
Bank Loans	3,600	-	(6,500)	-	-
Bonds	44,314	-	(3,423)	(81,108)	(6,500)
Sale of Assets	14,325	-	(807)	(8,760)	(12,289)
Stock Issues	32,412	-	(4,847)	(94,018)	(24,479)
Current Funds	144	-	(12)	(110)	-
Rental	1,374	-	(1,300)	(8,000)	4,382
Service Cos.	-	8,048	(4,124)	(324)	(1,384)
Total Capital	120,954	8,048	(16,321)	(192,320)	(43,611)
Total Associate	129,453	8,048	(97,521)	(192,336)	(43,611)

Gross Total Expenditures, Sector I and Sector II - $191,163,000

TABLE 37

Summary of Inter-Sectoral Transactions - 1951
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(94,701)	57,572	32,969	1,643	4,517
Development	(73,181)	47,116	5,585	551	19,929
Operating	(16,346)	3,040	10,759	1,179	1,368
Administration & Overhead	(18,423)	1,600	10,910	1,182	4,731
Royalties	(14,193)	-	11,369	1,883	941
Financial	(8,254)	-	845	6,223	1,186
Sub Total	(225,098)	107,328	72,437	12,661	32,672
Service Companies					
Operating		(98,035)	61,442	16,818	19,775
Capital		(18,235)	3,315	3,365	11,555
Total Expenditures	(225,098)	(8,942)	137,194	32,844	64,002
B. Working Capital Increases	(26,167)	(2,715)			
	(251,265)	(11,657)			
C. Sources of Funds					
(2) Current					
Sale of Products	118,953	-	(43,786)	(74,031)	(1,136)
(b) Capital					
Bank Loans	(600)	-	600	-	-
Bonds	9,521	-	(952)	(8,659)	-
Sale of Assets	14,804	-	(296)	(2,665)	(11,843)
Stock Issues	55,410	-	(7,056)	(31,056)	(17,298)
Converted Bonds	12,343	-	(1,234)	(11,109)	-
Residual	40,834	-	(834)	(10,000)	(30,000)
Service Cos.	-	11,657	(5,548)	(1,232)	(4,877)
Total Capital	132,312	11,657	(15,320)	(64,631)	(64,018)
Total Receipts	251,265	11,657	(59,106)	(138,662)	(65,154)

Total Expenditures, Sector I and Sector II - $234,040,000

TABLE C.37

Summary of Inter-Industry Transactions - 1963
(Thousands of Dollars)

	Sector I (Petroleum)	Sector II (Service Cos.)	Sector III (Alberta)	Sector IV (Rest of Canada)	Sector V (Rest of World)
A. Expenditures					
Exploration	(84,701)	57,374	22,209	1,043	4,517
Development	(23,187)	47,116	3,588	641	19,849
Operating	(16,788)	1,446	10,736	1,174	1,459
Distribution &					
Over-ead	(17,438)	1,908	16,810	1,102	4,731
Royalties	(14,143)	-	11,309	1,828	847
Overhead	(5,341)	-	535	6,322	1,181
Sub Total	(235,598)	107,834	65,437	12,081	32,573
Inter-Industries					
Crude	(44,024)		21,344	18,918	18,718
Capital	(18,300)		2,315	2,385	1,555
Total Expenditures	(297,922)	(5,814)	137,124	32,384	52,846
B. Working Capital					
Increase	(26,127)	(2,718)			
	(297,922)	(17,532)			
C. Sources of Funds					
(1) Current					
Sale of Products	212,052	-	(98,766)	(72,021)	(1,138)
(2) Capital					
Bank Loans	(700)	-	700	-	-
Bonds	7,212	-	(932)	(8,689)	-
Sale of Assets	14,304	-	(329)	(2,653)	(11,843)
Share Issues	55,210	-	(7,086)	(11,006)	(17,249)
Convertible Issues	19,344	-	(1,284)	(11,109)	-
Retained	10,984	-	(634)	(10,000)	(30,000)
Service Cos.	-	11,857	(8,348)	(1,323)	(4,677)
Total Sources	319,312	11,857	(15,330)	(64,031)	(64,318)
Total Uses	321,339	11,857	(96,160)	(120,363)	(66,164)

Total Expenditures, Sector I and Sector II - $329,000,000

TABLE 38

Summary of Inter-Sectoral Transactions - 1952
(Thousands of Dollars)

	Sector				
	I (Operators)	II (Service Cos.)	III (Alberta)	IV (Rest of Canada)	V (Rest of World)
A. Expenditures					
Exploration	(121,855)	67,728	45,600	2,346	6,181
Development	(83,295)	52,596	6,334	693	23,672
Operating	(20,739)	3,900	13,595	1,489	1,755
Administration & Overhead	(22,589)	2,000	12,900	1,538	6,151
Royalties	(18,113)	-	14,008	2,873	1,232
Financial	(10,841)	-	880	8,213	1,748
Sub Total	(277,432)	126,224	93,317	17,152	40,739
Service Companies					
Operating	-	(114,936)	73,122	14,414	22,400
Capital	-	(6,665)	2,457	(1,406)	5,614
Total Expenditures	(277,432)	4,623	168,896	35,160	68,753
B. Working Capital Increases	(16,284)	(3,669)			
	(293,716)	954			
C. Sources of Funds					
(a) Current					
Sale of Products	141,738	-	(48,533)	(90,578)	(2,627)
(b) Capital					
Bank Loans	(4,200)	-	4,200	-	-
Bonds	10,687	-	(896)	(8,068)	(1,723)
Sale of Assets	-	-	-	-	-
Stock Issues	80,312	-	(11,092)	(44,367)	(24,853)
Converted Bonds	7,712	-	(748)	(6,730)	(234)
Residual	57,467	-	(1,467)	(11,000)	(45,000)
Service Cos.	-	(954)	(1,136)	3,010	(920)
Total Capital	151,978	(954)	(11,139)	(67,155)	(72,730)
Total Receipts	293,714	(954)	(59,672)	(157,733)	(75,357)

Total Expenditures, Sector I and Sector II - $272,809,000

Summary of [illegible] - 1962

(Subsidiaries of Industry)

	Section				
	I	II	III	IV	V
	Corporation Service Co.,	Operating Services (Subsidiaries)	Plant of Industry	Plant of Industry	Plant of Industry
A. Investments					
Exploration	(124,889)	87,728	56,000	2,344	9,181
Development	(13,107)	52,396	6,234	896	25,275
Operating	(22,710)	2,842	13,560	[illegible]	[illegible]
Administration & Overhead	(32,880)	2,000	12,500	1,238	6,181
Royalties	(16,128)	-	14,[illegible]	2,[illegible]	1,272
Financial	(10,841)	-	[illegible]	1,[illegible]	1,[illegible]
Sub Total	(217,[illegible])	1[illegible],334	94,317	17,[illegible]	[illegible]
Service Companies					
Operating	-	(114,889)	74,127	10,414	25,400
Overhead	-	(8,[illegible])	2,477	1,[illegible]	2,[illegible]
Total Expenditures	(217,[illegible])	[illegible]	[illegible]	[illegible]	[illegible]
B. Working Capital Increase	(2[illegible],184)	(2,[illegible])			
	(2[illegible],[illegible])	[illegible]			

C. Sources of Funds

(a) Current

Sale of Products	141,732	-	(52,[illegible])	50,[illegible]	[illegible]
(b) Capital					
Bank Loans	(4,200)	-	4,200	-	-
Bonds	10,007	-	(888)	(1,000)	(1,725)
Sale of Assets	-	-	-	-	-
Stock Issues	80,312	-	(1,[illegible])	(4,[illegible])	(24,[illegible])
Convertible Bonds	7,712	-	(710)	(2,[illegible])	(924)
Residual	37,187	-	(1,[illegible])	(11,000)	(46,[illegible])
Service Cos.	-	(2[illegible])	(1,[illegible])	[illegible]	(920)
Total Capital	181,978	(984)	(11,[illegible])	(27,[illegible])	(73,710)
Total Receipts	2[illegible],714	(984)	(2[illegible],[illegible])	(1[illegible],[illegible])	(73,[illegible])

Total Expenditures, Sector I and Sector II = [illegible],000

There are matters of equal or greater interest which are within its scope, however. The primary purpose of this study has been to establish the basic data on which further studies may be based. As an indication of the lines further studies might take, some analysis of the data has been undertaken. This analysis has been along three basic lines.

(a) What data of interest appear from the figures themselves ? for example, how did the proportions of expenditure devoted to exploration, development, etc. vary and why ? Where did the money come from ? How much passed through the hands of Albertans ?

(b) What were average operating costs in this period ? How do they compare with those in the U.S., or in Canada since 1952 ? What are the differences between costs of acquiring new reserves in Canada and in the U.S. ? How can these be explained ?

(c) What were the effects on Alberta's economy ? On the Economy of Canada ? A complete analysis of these questions is again beyond the scope of this thesis but some partial answers can be provided.

Returning to the first line of inquiry outlined above, table 39 shows the proportions of expenditures devoted to various functions for 1947 - 52.

There are numerous to spend on greater difficulty which are within the scope, however, the primary purpose of this study has been to establish the basic data on which further studies may be based. As an indication of the data further analysis might take, some analysis of the data has been undertaken. This analysis has been along three basic lines:

(a) What kind of pressure, across time, can figures throughout the country, use the proportions of experiment developed in subsection, development, etc. Why and why? Where did the change come from? How much passed through the hands of students?

(b) What kind of pressure changes in this period? How do they compare with those in the U.S., or in Canada since 1951? What are the distinctive trends of experiment and research in Canada and in the U.S.? How did these on relative?

(c) What was the effect on Canadian economy? On the business of Canada? A comparative analysis of these questions is made against the backs of the Canadian and some general statements can be provided.

Beginning in the first line of analysis mentioned above, table 38 shows the proportions of experiment devoted to various functions for 1951 - 55.

Table 39

Functional Analysis of Expenditures 1947 - 52

(percentage of total expenditures by operators only)

	1947	1948	1949	1950	1951	1952
Exploration	32.6	45.8	48.0	44.8	42.0	43.9
Development	32.9	27.5	30.5	33.7	32.5	30.1
Operating	9.7	6.4	5.3	5.3	7.3	7.5
Administration & Overhead	7.5	8.0	8.4	8.4	8.2	8.1
Royalties	5.5	5.3	4.4	4.0	6.3	6.5
Financial	11.8	7.0	3.4	3.8	3.7	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Examination of this table indicates that it is merely a reflection of history, and is explainable easily on the basis of events. It is of no value in explaining the relationships. The increase in spending on exploration 1947-49 is a result of a large number of new entries into the industry. These had no crude and had to go looking for it, reducing the proportion of funds available for other purposes. Boom-like development of the Redwater field, starting in earnest in 1949 and virtually complete by December 1951 reversed this trend. 1952 saw some shift back into exploration as discovery of the Wizard Lake-Bonnie Glen reef trend sparked an exploratory "play" in the deeper basin area south and west of Leduc. The ups and downs in the share of operating cost and royalties merely indicates the extent to which production kept pace with or lagged behind expenditures. Changes in "financial" expenditures reflect mostly the lag in income taxes as write-offs of exploratory costs reduced tax liabilities. Financial payments in the earlier years are related to the pre-1947 level of activity. The decrease in percentage after 1947 is due to the rise in other expenditures.

Table 39

Functional Analysis of Expenditures 1947 - 52

Mining

(percentage of total expenditures by operators only)

	1947	1948	1949	1950	1951	1952
Exploration	34.4	35.0	35.0	44.8	42.0	43.2
Development	32.0	27.8	29.8	22.1	32.0	30.1
Operating	9.7	8.4	8.3	8.3	7.8	7.8
Administration & Overhead	7.8	8.0	8.4	8.4	8.8	8.1
Royalties	8.8	8.8	4.6	4.0	6.3	6.8
Financial	11.3	7.0	4.4	3.2	3.7	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Examination of this table indicates that it is merely a reflection of history, and is explicable mainly on the basis of events. It is of no value in explaining the relationships. The increase in spending on exploration 1947-48 is a result of a large number of new entries into the industry. These had no stake and had to go looking for it, reducing the proportion of funds available for other purposes. Subsequent development of the Rouyn-Noranda field, starting in earnest in 1949 and virtually complete by November 1951 reversed this trend. 1952 saw some shift back into exploration as discovery of the Wizard Lake-Bonnie Glen coal trend sparked an exploratory "play" in the deeper basin area south and west of Edson. The ups and downs in the share of operating cost and royalties merely indicates the extent to which production kept pace with or lagged behind expenditures. Changes in "financial" expenditures reflect mostly the lag in income taxes as write-offs of exploratory costs reduced tax liabilities. Financial payments in the earlier years are related to the pre-1947 level of activity. The decrease in percentage since 1947 is due to the rise in other expenditures.

Perhaps more illuminating is an analysis of where the money was spent.

Table 40 shows the geographical expenditure pattern, for all expenditures, including those of service companies. (Net expenditures of service companie from table 33 - 38 were used to eliminate duplication)

Table 40

Geographical Analysis of Expenditures
1947 - 52

(Percentages of total expenditures, operators and service companies)

	1947	1948	1949	1950	1951	1952
Alberta	48.5	55.8	62.6	61.6	58.7	61.8
Other Canada	19.5	16.5	12.9	11.9	14.0	13.0
Foreign	32.0	27.7	24.5	26.5	27.3	25.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

These figures illustrate the extent to which the local industry was dependent on the U.S. for equipment and services during these early years. Much of the apparent fluctuation in the shares spent in other parts of Canada and abroad is due to variations in the share of expenditure accruing to landholders in Alberta, principally the Crown, in bonuses, rentals and royalties. This item varied as follows:

	Percent of total expenditures
1947	5.8
1948	18.3
1949	23.5
1950	22.6
1951	16.5
1952	19.3

If we remove the influence of this variable by taking amounts spent in the three geographical areas exclusive of the above land costs as percentages of total spending less payments to Alberta landowners, a different picture emerges. This is shown in Table 41.

Farming and ranching is the mainstay of Alberta's economy, as it has been from the time of the first settlers.

Table 4A shows the occupations of employed persons, by sex, in Alberta, according to census classifications (with comparisons of annual averages from Table 3A - 1A were used to eliminate seasonality).

Table 4A

Occupational Distribution of Employed Persons
Alberta - 1961

(Data shown in total occupations, equivalent and special occupations)

	1961		1960		1959		1958		1957	
Occupation										
Other Jobs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Farming	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	100.0	[illegible]	100.0	[illegible]	100.0	[illegible]	100.0	[illegible]	100.0

These figures indicate the extent to which the local industry was dependent on farm labour, particularly during those early years. Much of the increase (decrease) in the above figures is other than at farming and farmed lands, for variations in the labour of occupations according to particulars in alberta, principally the Census, in Canada, median and regardless. This item varied as follows:

Percent of total occupations

1961	9.8
1960	[illegible]
1959	[illegible]
1958	[illegible]
1957	[illegible]
1956	[illegible]
1951	[illegible]

It was [illegible] the influence on this variable by taking accounts upon 1 on farms, [illegible] across variability of the farm land scale as percentages of total occupied farm population in Alberta land-ownership, a different source accounts. This is shown in Table 5A.

Table 41.

Geographical Analysis of Expenditures, excluding payments to Alberta Landowners, 1947 - 1952

(Percentages of total expenditures by operators and service companies excluding payments to owners of mineral rights in Alberta).

	1947	1948	1949	1950	1951	1952
Alberta (except land)	45.3	45.9	51.1	50.5	50.5	52.6
Other Canada	20.7	20.2	16.9	15.4	16.8	16.1
Foreign	34.0	33.9	32.0	34.1	32.7	31.3

The figures in table 41 indicate very little change in the percentage of expenditures going abroad, with a modest increase in the share of expenditures going to Alberta at the expense of other parts of Canada.

It is difficult to pinpoint the exact reasons for this shift. Part of it is due to a relative decline in the importance of royalties received by railway companies for land in Alberta, the rest apparently to some shifts in the location of industries supplying the petroleum industry from Eastern Canada to Alberta or to the establishment of new industries in Alberta. In any case the changes were relatively minor. It is surprising that Canadian firms did not develop an increased share of this growing market over this six year period. Looking at developments since 1952, it seems probable that a greater percentage of the oil expenditure dollar remains in Canada. Casing, tubing line pipe, sucker rods, pumps, tanks and drilling bits are now made either in Alberta or the East. It is perhaps significant

Table 41

Geographical Analysis of Expenditures, excluding payments to Alberta Landowners, 1947 - 1952

(Percentages of total expenditures by operators and service companies excluding payments to owners of mineral rights in Alberta).

	1947	1948	1949	1950	1951	1952
Alberta (except Isen.)	46.1	48.4	51.1	50.5	50.3	52.8
Other Canada	20.7	20.2	18.8	15.6	16.0	14.1
Foreign	33.0	31.3	32.1	33.1	33.7	33.2

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that most of these new firms are owned largely in the U.S. or Europe, and that established Canadian industry has been indifferent to the needs of this market.

For example, out of five new firms manufacturing casing or line pipe, three are German-backed, one was established by Eastern Canadian steel interests and one by local capital. One additional firm was established in Ontario some years ago. With respect to tanks, all new firms are U.S. controlled. An Edmonton firm, promoted locally, makes sucker rods.

This has undoubtedly been a factor in the postwar growth of foreign investment in Canada.

Let us look for a moment at sources of funds. The first comparison we shall make is between "current" sources, including sales receipts and "capital" sources including stocks, bonds, and all the rest. Table 42 shows this breakdown.

Table 42

Sources of Funds, 1947 - 52

	Current %	Capital %
1947	41.7	58.3
1948	36.3	63.7
1949	37.8	62.2
1950	41.7	58.3
1951	47.3	52.7
1952	48.3	51.7

These figures suggest that from the outset, a substantial portion of required funds came from sales receipts. In view of the rapid growth in the industry, a larger relative contribution from capital sources might have been expected.

that most of these new firms are owned largely in the U.S. or Europe, and that established Canadian industry has been indifferent to the needs of this market.

For example, out of five new firms manufacturing casing or line pipe, three are German-backed, one was established by Eastern Canadian steel interests and one by local capital. One additional was established in Ontario some years ago. With respect to tanks, all new firms are U.S. controlled. An Edmonton firm, promoted locally, makes sucker rods.

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Table 42

Sources of Funds, 1947 - 52

	Current %	Capital %
1947	41.7	58.3
1948	16.3	83.7
1949	37.8	62.2
1950	41.7	58.3
1951	47.5	52.7
1952	46.3	51.7

These figures suggest that from the outset, a substantial portion of required funds came from sales receipts. In view of the rapid growth in the industry, a larger relative contribution from capital sources might have been expected.

The declining importance of capital funds from 1948 to 1952 tends to indicate that budgets of all operators are dependent in part on income being earned. This is at variance with the generally accepted view that the major international companies regard their Canadian operations as a means of assuring future supplies, that they are merely buying oil in the ground and are not concerned with current income levels. The major premise may be true but the conclusion seems at variance with observed facts.

It would appear from the percentages above that capital expenditure budgets are related to current receipts, and that expenditures are only made with a view to obtaining payout in a reasonably short period.

Another facet of the financing picture is illustrated in table 43. This table shows the types of capital investments made in the industry.

Table 43

Types of Capital Investment Operating Companies 1947-52

(showing percent of annual funds coming from specified sources, Service Companies excluded).

	1947	1948	1949	1950	1951	1952
Bank loans	1.1	3.9	3.3	3.0	(0.4)	(2.8)
Bond Issues	(-.4)	(.4)	7.2	36.1	7.2	7.0
Sale of Assets	-	58.0	28.4	12.8	11.2	-
Public Stock issues	17.1	7.9	20.2	44.5	41.8	52.9
Converted Bonds	-	-	-	-	9.3	5.1
Residual (including direct)	82.2	30.6	41.0	3.6	30.9	37.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

The declining importance of capital issues during 1948 and 1952 tends to indicate that budgets of all companies are dependent in part on income being earned. This is in variance with the generally accepted view that the major international companies remain that Canadian operation as a means of securing future supplies, that they are merely buying oil in the ground and are not concerned with current income levels. The major premise may be true but the tendencies seems at variance with observed facts.

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Another fact of the foregoing figures is illustrated in table 43. This table shows the types of capital investment in the industry.

Table 43

Types of Capital Investment Operating Companies
1947-52

(showing percent of annual funds coming from specified sources, Service Companies excluded)

	1947	1948	1949	1950	1951	1952
Bank loans	1.1	8.8	3.3	7.0	(0.4)	(2.8)
Bond issues	(-)	(-)	7.2	39.1	7.3	7.0
Sale of Assets	-	38.0	28.4	12.8	11.1	-
Public Stock Issues	14.1	7.3	20.4	44.5	61.6	32.3
Government Loans	-	-	-	-	9.2	8.1
Residual (including depreciation)	85.2	80.3	41.0	8.6	30.5	57.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Several generalizations regarding methods of financing may be drawn from the above table.

Firstly, the contribution of the chartered banks was insignificant in the total picture during this period. This might be expected in view of the underlying philosophy of the Canadian banking system which regards banks as essentially a source of short term credit. Oil financing is generally of a medium term variety. At this time there was no provision in the Bank Act allowing banks to take security on oil in the ground. The above underestimates the role of the banks somewhat, as a number of banks got around the problem raised by the Bank Act by purchasing bonds issued by oil companies. Many loans were made on a short term basis, and replaced with bond issues at a later date. This relatively elaborate and expensive procedure was made unnecessary by the new Bank Act of 1954 (3), section 82 of which enabled the direct taking of security on producing properties.

Capital raised by the sale of bonds, which includes a portion raised from the banks, did not become a significant factor until 1949, when the industry had progressed sufficiently beyond the first waves of speculation to see which way it was going. In 1950 bonds which had either convertible features or bonus stock attached enjoyed a brief flurry of popularity. Most of these promotions were based on the development of proven properties in the Redwater field, and the companies' operations were of a less speculative nature than most oil companies' ventures. Essentially most of the 1950 bond issues

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(3) 2 - 3 Elizabeth II, c.48

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(3) 2 - 3 Elizabeth II, c.48

had so much speculative "sweetening" in the form of convertibility privileges, bonus stock, or purchase warrants, that they should be regarded as equity investments in nature if not in form. This is borne out by the rapidity with which such issues were converted (when possible) in subsequent years. By 1951 bonds had subsided to a position of relative unimportance similar to that held in 1949. Bonds have never been a major source of oil producing industry financing either in Canada or the U.S. (4)

An unusual source of funds which appears in our table is the sale of assets. These transactions were discussed at some length in Chapter Four, above, where it was noted that these funds were raised by one company in two transactions whereby it disposed of one domestic and one foreign subsidiary to raise funds for Canadian development. It is interesting to compare this approach with that of other Canadian affiliates of international majors, which retained foreign holdings while producing operations in Western Canada were entrusted to newly-formed subsidiaries, usually 100% owned by the group parent or at least a high-level holding company. Participation of these other Canadian majors in domestic production operations was relatively slight and usually in partnership with the producing affiliate..

The two chief sources of funds were public stock issues and what we have classed as "residual" investment, of which the major component is direct investment by foreign firms in branch operations or wholly owned subsidiaries. This latter was an indispensable source of funds in the early years, and of consequence throughout the period. Public stock offerings, a major source of funds prior to 1947, were completely

(4) For discussion of the reasons for this see Guthmann, H.G. and Dougall, H.E. Corporate Financial Policy (New York, 1948) pp 172-173

unable, at first, to provide funds on the scale required by the rate of expansion. Their growth in importance to a position where they supplied the majority of funds required in 1952, attests to the potentialities of this source and the sometimes excessive marketability of Canadian oil stocks.

Another classification of particular interest in view of the continued discussion of the extent of foreign ownership in Canadian industry, is that given in Table 44. This table shows the geographic sources of capital funds, including all sources of funds except sales receipts. It is concerned with original sources only. For example, when stock is sold originally to a Canadian investor, the source of funds is classified as Canadian, whether or not he turns around a week or five years later and sells his stock to a foreigner.

Table 44

Geographic Sources of Capital Funds, Operating Companies 1947-52

(Percentage Coming from specified sources)

	1947	1948	1949	1950	1951	1952
Alberta	14.6	10.1	10.1	11.5	7.4	6.6
Other Canada	42.0	24.7	41.7	55.0	47.8	46.2
Foreign	43.4	65.2	48.2	33.5	44.8	47.2
Total:	100.0	100.0	100.0	100.0	100.0	100.0

This table indicates that the share of capital coming from Alberta sources dropped slowly over the period. This does not indicate a drying up of local sources, but shows their inability to keep pace with the growth that occurred. The share supplied by other parts of Canada fell drastically in a relative sense in 1948, though it increased in absolute amount. The position was regained in 1949 and Canadian sources

supplied a good proportion of requirements until 1952. There is no evidence in these estimates to support the thesis that Canadian Investors have been unwilling to invest in development of their own country. It is, however, interesting to note that peak Canadian participation took place in 1950, the year in which "bonds" were so popular. This does tend to suggest a weakness for this form of investment. One reservation might be added to the above comments. The above figures are based on initial sources of funds, and do not indicate the final resting place of securities in portfolios. It would be quite possible that 100% of the funds could come originally from Canadian sources but that control would pass outside Canada. This would occur if Canadian investors took their profits (or losses) and sold out to foreign investors. Other evidence seems to indicate that something like this did occur.

Table 45 shows estimates by the Dominion Bureau of Statistics which show changes in the book value of foreign investment in Canada's oil industry, from 1945 to 1951. These are compared with our estimate of the source of capital funds for the period 1947-52. Comparison of these two sets of figures suggests that Canadian investors did sell some of their holdings, enough in fact to give foreigners a majority interest.

Table 45

Sources of Investment in the Petroleum Industry

	D.B.S. Estimates 1945-51(5)		Our Estimates 1947-52	
	$ Million	%	$ Million	%
Alberta			54.7	9.1
Rest of Canada			270.3	45.0
Sub Total	406	43.7	325.0	54.1
Foreign	523	56.3	275.5	45.9
	929	100.0	600.5	100.0

(5) DBS. Reference Paper 37, International Distribution of Ownership of the Petroleum Industry in Canada, Ottawa, Nov. 1952. These estimates include refining, marketing and transportation companies and are thus not directly comparable.

The second line of analysis mentioned earlier in this chapter concerned estimated producing costs. Conventional industry practise includes only the first four classes of expenditures:

(a) exploration or acquisition costs

(b) development costs

(c) operating costs

(d) administration and overhead

To be realistic, the first two classes should be charged against the reserves found during the period under consideration. Operating and overhead costs can be charged against barrels produced. As the purpose of the analysis which follows is to present data for the period 1947-52 which are comparable to other estimates by industry sources, we have followed conventional practise by treating royalty production as never owned, hence not an expense, and will ignore financial charges.

Table 46 indicates the physical quantities used in our estimate of producing costs. Gas has been ignored as it was a minor factor during this period. The column showing 'net' production and reserves is calculated by subtracting royalties at an estimated 12½% percent from the gross figures. Total additions to net reserves are used in calculating development cost. While some reserves may not be developed, by A.P.I. definitions, proved reserves include only a slight margin of undrilled acreage beyond known production. The error introduced into a six year estimate by the inclusion of a small quantity of undrilled reserves is slight,

The second [illegible] considered exploration, development, operating and abandonment costs. Excluded only the first three items of development.

(a) exploration or prospecting costs

(b) development costs

(c) operating costs

(d) abandonment and overhead

To be realistic, the derived charges should be compared against the reserves found during the period under consideration. Operating and overhead costs can be charged against barrels produced. As one purpose of the analysis was taken to be present data for the period 1947-61 which are comparable to other estimates by industry sources, we have taken reserves found during the period under consideration as never proved, [illegible] of [illegible] conventional [illegible].

Table 47 indicates the [illegible] multiplying our estimate of producing costs. Depletion [illegible] is a major factor during this period. Exploration [illegible] and reserves is calculated by subtracting revisions in reserves estimates from the gross figures. Total additions to net reserves are used to calculate exploration costs. While some reserves may not be developed by A.P.I. definitions, proven reserves include only a small quantity of undrilled acreage, proven beyond reasonable. The error introduced into costs was reduced by the inclusion of a small quantity of undrilled reserves in algal.

Table 46.

Physical Quantities for Producing Cost Estimate 1947 - 52

(Thousands of Barrels)

			Gross	Net
A.	Production	(6) 1947	6,382	
		1948	10,505	
		1949	19,769	
		1950	27,148	
		1951	45,915	
		1952	58,916	
	Total 1947 - 52		168,635	147,556
B.	Reserve Changes			
	add reserves 31. Dec 1952(7)		1,591,763	
	less reserves 31 Dec. 1946(8)		45,000	
	Total change in reserves		1,546,763	
C.	Total Oil Found		1,715,398	1,500,973

Table 47 summarizes the cost components used.

Table 47.

Components of Producing Cost Estimate 1947-52

(Thousands of Dollars)

	Exploration	Development	Operating	Admin & Overhead
1947	9,925	10,007	2,950	2,288
1948	30,611	18,375	4,320	5,331
1949	67,486	42,902	7,391	11,778
1950	83,311	62,926	9,947	15,618
1951	94,701	73,181	16,346	18,423
1952	121,855	83,295	20,739	22,589
	407,889	290,686	61,693	76,027

Table 48 gives estimated producing cost for the period.

No attempt has been made to calculate annual figures. Wide year to year fluctuations, particularly in exploration cost per barrel characterize this period. This is because a single discovery may result from several

(6) Conservation Board Alberta Petroleum Industry annual volumes 1947-52
(7) American Petroleum Institute, Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas, December 31, 1952, New York, 1953.
(8) Royal Bank of Canada, Bulletin 17, Industry Statistics Calgary, June 1st. 1953.

Table 41.

Physical Operations for Producing Gas Industry: 1947 - 52

(Thousands of Barrels)

		Gross	Net
A. Production - (8) 1947		9,352	
1948		11,408	
1949		12,174	
1950		13,146	
1951		15,812	
1952		17,410	
Total 1947 - 52		79,312	147,852
B. Reserve Changes			
and reserves in Jan 1952(1)	1,874,270		
less reserves in Jan. 1947(2)	1,727,000		
Total change in reserves	147,270		
C. Total Gas Power		1,174,388	1,000,470

Table 41 summarizes the gas conservation data.

Table 42.

Conservation of Producing Gas Industry 1947-52

(Thousands of Dollars)

	Employment	Development	Operating	Ratio of Operating to Total
1947	3,232	10,007	2,000	2,000
1948	10,241	13,276	2,000	2,221
1949	17,212	11,241	3,281	11,772
1950	21,311	13,212	8,007	12,212
1951	28,701	13,181	12,000	12,020
1952	17,170	20,224	20,102	22,088
	97,900	100,038	47,000	70,027

Table 42 gives estimated producing cost for the nation.

Co attempt has been made to calculate annual reserves. This year to year fluctuations, particularly in exploration cost for better discoveries this period. This is because a single discovery may result from several

(6) Conservation Board Alberta, Petroleum Industry annual volume 1947-52
(7) American Petroleum Institute, Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas, December 31, 1952, New York, 1953.
(8) Royal Bank of Canada, Calendar 17, Industry Statistics Canada, Montreal, 1953.

years work and is so large relative to existing reserves as to completely change the picture. It is felt that a six-year estimate is more realistic.

Table 48

Crude Oil Producing Cost, Alberta, 1947 - 52

	Cost $000	'000 Net Barrels	Cost ¢ per net barrel.
Exploration	407,889	1,500,973	27.2
Development	290,686	1,500,973	19.4
Operating	61,693	147,556	41.8
Administration and overhead	76,027	147,556	51.5
Total Per Barrel			139.9

The average sales revenue per Barrel of crude sold, including receipts from gas and other by-products, for the period 1947-1952, was 2.76 (9) Indicated net profit, before income taxes, therefore, was $1.36 per net barrel.

Some comparable statistics are presented in Table 49. These indicate that :

(1) Producing costs in Western Canada under current conditions have not changed much from those experienced in Alberta during the early postwar years.

(2) Producing costs in the U.S. in the 1947-52 period were substantially higher in all respects than in Alberta at the same period, and were rising.

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(9) Table 15 supra, total receipts, divided by gross barrels, Table 46.

Table 49

Comparison of Producing Costs
(Cost per Net Barrel)

	Alberta	Western Canada	U.S.A.(11)	
	1947-52	1951-56 (10)	1948	1952
Exploration	27.2	57.2	64.0	99.4
Development	19.4	35.4	45.8	57.2
Operating	41.8	41.2	51.4	74.4
Admin and overhead	51.5	*	*	*
Total:	139.9	133.8	161.2	231.0

* Included in Exploration and Development

Several factors contribute to the difference between Canadian and U.S. costs. Operating expenses are higher largely because of the number of stripper wells in older producing areas in the U.S. These costs tend to be more closely related to the number of wells operated rather than to production. When per-well production is lower, per-barrel cost is higher.

Factors contributing to differences in development cost include:

(a) There are relatively more deep development wells (10,000 feet and over) drilled in the U.S.

(b) Offshore development costs are much higher. This was not a large factor in the 1947-52 period but contributed.

(c) Well spacing in the U.S. tends to be narrower. Typical spacing in the 1947-52 period was 10-40 acres per well. In Alberta it was almost universally 40 acres.

(10) Western Canada 1951-56, Per Gross Barrel estimate from Canadian Petroleum Association, Submission to the Royal Commission on Energy, Calgary, February 7, 1958, Converted to net barrel basis.

(11) U.S.A. 1948, 1952. Struth, H.J. Rising Costs Justify Higher Crude Prices, World Petroleum (vol. 26 No. 13). December 1955, p 62 Costs per gross barrel converted to net barrel basis.

Table 10

Comparison of Producing Costs[1]
(Cost per net barrel)

	Alberta	Western Canada	U.S.A.[10]
	1947-52	1951-52 (a)	1948
Exploration	23.2	27.3	29.0
Development	18.4	32.4	26.8
Operating	41.3	41.3	51.4
Admin and overhead	17.1	*	*
Total	100.0	100.0	107.2

* Included in exploration and development.

Several factors correlate to the differences between Canadian and U.S. costs. Operating expenses are higher largely because of the number of stripper wells in older producing areas in the U.S. These costs tend to be more closely related to the number of wells rather than to production. Thus, U.S. productivity is lower, operating costs are higher.

Factors contributing to differences in development expenditures are:

(a) There are relatively more deep development wells (10,000 feet and over) drilled in the U.S.

(b) Drilling development costs are much higher. This was not a large factor in the 1947-52 period we considered.

(c) Well spacing in the U.S. tends to be narrower. Typical spacing in the 1947-52 period was 10-40 acres per well. In Alberta it was closer, averaging 40 acres.

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(10) Western Canada 1951-52. Per cents have been rounded. From Canadian Petroleum Association, Submission to the Royal Commission on Energy, Calgary, February 7, 1958. Converted to net barrel basis.

(11) U.S.A. 1948. Petroleum Week, U.S. Mining Congress Bulletin, Mineral Prices, World Petroleum (ed. E. De. Golyer), December 1953, p. 82. Costs per gross barrel converted to net barrel basis.

There is also a wide gap in exploratory costs. One explanation is that in the U.S. the remaining oil fields are becoming harder to find, while in Canada technical opinion suggests that the bulk of the discoveries has yet to be made [12]. There is undoubtedly some truth to these statements, but it seems to be also true that oil was easier to find in the U.S. than in Canada prior to 1947. It is thus doubtful whether this is an adequate explanation of the cost differential.

A more subtle explanation lies in the relative intensity of spending for drilling and for geological and geophysical surveys.

In 1952, Alberta operators spent $34,400,000 on exploratory drilling and $46,440,000 on surveys. (13) This is a ratio of $1.35 in surveys for every dollar in drilling. In the U.S. in 1952, operators spent $1,217 million for exploratory drilling and $193 million on surveys, (14) or only $0.16 on surveys for every dollar in drilling.

It is well known that geological and geophysical studies are an aid in exploration. Probably this is a more significant reason for the differences in exploratory costs between Alberta and the U.S. It should be possible to determine, from a study the statistics available for geophysical operations, exploratory drilling and reserves, what is an optimum economic program for exploring given acreage. This is again beyond the scope of this study.

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(12) Canadian Petroleum Association. op.cit.
(13) Table 3, supra.
(14) Struth, H.J. Efficient practices reduced 1954 exploration costs. World Petroleum (vol. 26 No. 3). March 1955. p. 61.

There is also a disadvantage in exploratory costs. One explanation is that in the U.S. the remaining oil is the more becoming harder to find, while in Canada, [illegible] opinion suggests that the bulk of the discoveries has yet to be made[12]. There is undoubtedly some truth to these statements, but it seems to be more than was easier to find in the U.S. than in Canada prior to 1947. It is true doubtful whether this is an adequate explanation of the cost differential.

A more subtle explanation lies in the relative intensity of exploration for drilling and for geological and geophysical surveys.

In 1962, Alberta operators spent $14,400,000 on exploratory drilling and $60,000,000 on surveys, (13) this is a ratio of $1.25 in surveys for every dollar in drilling. In the U.S. in 1962, operators spent $1,312 million for exploratory drilling and $377 million on surveys, (14) or only $0.28 in surveys for every dollar in drilling.

It is well known that geological and geophysical surveys are an aid in exploration, probably that is a more significant consideration for the differences in exploratory costs between Alberta and the U.S. It should be possible to determine, from a study the statistics available for geophysical operations, exploratory drilling and surveys, what is an optimum economic program for exploring given acreage. This is well beyond the scope of this study.

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(12) Canadian Petroleum Association, op.cit.
(13) Table 3, supra.
(14) Spring, W.A., Petroleum production costs (1963 exploration costs), World Petroleum, Vol. 35 (2), 3, March, 1964, p. 54.

Perhaps the most significant questions regarding this industry, to outsiders at least, are the following :

(1) What effect has the growth of the industry had on the economy of Alberta ?

(2) What effect has its growth had on the economy of Canada ?

Some of the answers to these questions are familiar, almost to the point of being clichés. The industry has contributed to the diversification of the Alberta economy, giving the province a second "cash crop". It has provided employment for large numbers of people. Availability of Canadian crude has "saved" Canada a lot of foreign exchange and helped to make the Canadian dollar go to a premium over its U.S. counterpart. The influx of population has contributed to the financial problems of the urban municipalities. Alberta has become a "Debt-free" province. The above statements are all true, and important as far as they go. Few of them have been assessed quantitatively, and they are all "side-effects" or, at best, only part of the story.

The most all-inclusive measure of the effect would be the estimated effect of the industry's growth on the Gross National Product of Alberta and of Canada. Preparation of such an estimate would involve construction of econometric models of the economies in question. Construction of such models is beyond the scope of this thesis. It does provide however, the essential raw materials which, together with such a model, will enable calculation of income effects.

Income effects due to any new industry or change in scale of an existing one may be divided into "primary" and "secondary" effects. The former result directly from increased investment or changes in imports and exports in the initial round of spending. Secondary effects are those

In this Thesis, the author attempts to evaluate the operating and industry interdependence between, amongst subjects:

(1) Petroleum refining, the growth of the industry had on the economy of Alberta;

(2) Oil refining has had on the economy of Canada;

Some of the answers to these questions are qualitative, almost to the point of being obvious. The industry has contributed to the diversification of the Alberta economy, in that it provides a second "staple" crop. It has provided employment for large numbers of people. Availability of Canadian crude has "saved" Canada a lot of foreign exchange and helped to make the Canadian dollar up to a premium over the U.S. equivalent. The growth of petrochemicals contributed to the industrial problems of the prairie municipalities. Alberta has become "Canada-free" province. The above statements are allusive, and approximate as far as they go. Few of them are measured or measurable. Too they are all "aggregate" or at least "only part of the story".

The point of interest emerges of the author would better estimate effect of the industry's growth on the Gross National Product of Alberta and of Canada. Preparation of such an estimate would involve construction of econometric models of the economies in question. Construction of such models is beyond the scope of this thesis. It does appear however, that essential pre materials work, together with such preliminary, will enable calculation of income effects.

Income effects due to any new industry on changes in mode of an existing one, may be divided into "primary" and "secondary" effects. The former result directly from increased investment or changes in imports or exports in the initial round of spending. Secondary effects are those

induced changes in other parts of the economy resulting from the working of various multipliers. From our date, it is possible to calculate primary income effects. The components of primary income are as follow

(a) Investment made by the industry.

(b) Export sales made by the industry.

(c) Less import content of Industry Expenditures.

(d) Plus imports avoided due to existence of the industry.

These are categories correspond to these used in the national accounting concept "Gross National Expenditures at Market Prices" (15)

The last category (d) needs further explanation. In 1946 Alberta was a net importer of petroleum and petroleum products, as was Canada. If the producing industry had not developed, both would have been larger importers in the years 1947-52. Without resort to dynamic input-output analysis, it is most difficult to say how much of the consumption in these years would have been avoided if the industry had not contributed to economic development and hence to consumption. A further problem arises when we consider that Alberta had oil and gas production valued at $21,532,000 in 1946(15)a.In volume this was declining annually, but the course of prices would have been far difference if local production had not developed. To provide for some continuation of previous production and for the amount of consumption that wouldn't have taken place if the industry hadn't developed, the following arbitrary amounts have been chosen : (in thousands of dollars).

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(15) D.B.S. National Accounts, Income and Expenditures 1926-1950 Ottawa, 1952.

(15)a Table 1 supra.

induced changes in other parts of the economy (leading from the working of various multipliers). Thus, our data, it is possible to calculate primary income effects. The components of primary income are as follows:

(a) Investment made by the industry,

(b) Export sales made by the industry,

(c) Less import content of industry expenditures,

(d) Plus income received due to existence of the industry.

These are conceptual correspondence to those used in the national accounting concept "Gross National Expenditure at Market Prices" (18)

The last category (d) takes further explanation. In 1966 Alberta was a net importer of petroleum and petroleum products, as was Canada. If the producing industry had not developed, such totals have been larger imports in the years (1966-67). Without reason to consider import-substitute outputs, it is most difficult to say how much of the consumption in these years would have been satisfied if the industry had not contributed to economic development and income in consumption. A further problem arises when we consider that Alberta had oil and gas production valued at $41,032,000 in 1966-67. To avoid this we subtract annually, that the course of value would have been for difference if local production had not developed. To provide for some modification of previous production and for the amount of consumption that would have been taken place if the industry hadn't developed, the following adjustment amounts have been chosen : (in thousands of dollars).

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(18) F.D.B. National accounts, Supplement to Economic Review 1966-1969 (Ottawa, 1969).

(Adc. Table 1 Appx.)

1947	15,000
1948	17,000
1949	18,000
1950	20,000
1951	23,000
1952	26,000

These amounts have been deducted from sales of products in Alberta and Canada in Tables 50 and 51 to provide an estimate of the net reduction in imports made possible by the existence of this industry in Alberta.

In tables 50 and 51, both exploration and development expenditures have been treated as investment, together with capital expenditures by service companies.
This is not in keeping with industry accounting practise, which is to write off exploration as an expense, but follows the national accounting framework of the Dominion Bureau of Statistics (16)

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(16) D.B.S. National Accounts, Income and Expenditures 1926-1950 Ottawa, 1952, p.101

(10) T.E.S., Imperial Oil Review, Toronto and Edmonton 1936-1950 Canada, 1951.

TABLE 50

Primary Income Effect of Alberta Petroleum Producing Industry Growth on Alberta: 1947-52
(Millions of Dollars)

		1947	1948	1949	1950	1951	1952
	Exploration Expenditures	9.9	30.6	67.5	83.3	94.7	121.9
ADD	Development Expenditures	10.0	18.4	42.9	62.9	73.2	83.3
ADD	Service Company Capital Expenditures	4.5	9.3	7.8	12.1	18.2	6.7
ADD	Export Sales - Rest of Canada	3.0	10.1	24.1	36.4	74.0	90.6
ADD	- Foreign	-	-	-	-	1.1	2.6
ADD	Domestic Sales (Imports avoided)	17.3	27.5	37.6	49.1	43.8	48.5
SUBTRACT	Deduction from Domestic Sales	15.0	17.0	18.0	20.0	23.0	26.0
SUBTRACT	Leakages - Import Content - - Rest of Canada	6.6	12.1	18.5	22.5	32.8	35.2
SUBTRACT	- Foreign	10.8	20.5	35.1	50.6	64.0	68.8
	PRIMARY INCOME EFFECT(GNE)	12.3	46.3	108.3	150.7	185.2	223.6

TABLE 29

Primary Iron and Steel in Alberta Exports by Commodity Destination Country or Area, 1973-80
(Millions of Dollars)

		1973	1974	1975	1976	1977	1978
[illegible]	Exploration Expenditures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Development Expenditures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Service Company Total Expenditures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Direct Sales - Prov. to Canada	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	- Foreign	-	-	-	-	[illegible]	[illegible]
[illegible]	Domestic Sales Company Employees	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Direct Service Sales - Canada	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Direct Service Sales - Foreign	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	- Foreign	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	TOTALS: EXPLORATION/DEVELOPMENT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 51

Primary Income Effect of Alberta Petroleum Producing Industry Growth on Canada: 1947-52
(Millions of Dollars)

		1947	1948	1949	1950	1951	1952
	Exploration Expenditures	9.9	30.6	67.5	83.3	94.7	121.9
ADD	Development Expenditures	10.0	18.4	42.9	62.9	73.2	83.3
ADD	Service Company Capital Expenditures	4.5	9.3	7.8	12.1	18.2	6.7
ADD	Export Sales	-	-	-	-	1.1	2.6
ADD	Domestic Sales, Alberta	17.3	27.5	37.6	49.1	43.8	48.5
	Rest of Canada	3.0	10.1	24.1	36.4	74.0	90.6
SUBTRACT	Deduction from Domestic Sales	15.0	17.0	18.0	20.0	23.0	26.0
SUBTRACT	Leakages - Import Content	10.8	20.5	35.1	50.6	64.0	68.8
	PRIMARY INCOME EFFECT	18.9	58.4	126.8	173.2	218.0	258.8

TABLE 14

Primary Income Effect of Alberta Manufacturing Producing Industry Growth on Canada, 1967-82
(Millions of Dollars)

		1967	1968	1969	1980	1981	1982
	Population Dependency	0.9	30.4	67.6	85.8	94.7	121.0
ABD	Development Expenditures	-0.0	16.4	44.0	65.5	73.8	88.5
ABD	Service Company Capital Expenditures	4.3	6.3	7.8	14.4	18.8	8.7
ABD	Export Sales	-	-	-	-	1.7	2.0
ABD	Resource Sales, Alberta	17.0	44.4	37.0	14.1	60.5	36.0
	Total of Canada	3.0	37.1	24.1	88.4	44.4	10.0
BUS INDUCT	Dividends Less Commodity Sales	12.0	4.0	38.0	37.0	30.0	32.0
BUS INDUCT	Dividends - Labour Income	10.4	30.1	34.1	81.8	84.5	41.4
PRIMARY MULTIPLIER EFFECT		14.3	38.4	137.8	172.2	318.0	384.3

Tables 50 and 51 indicate primary income generated in Alberta and all of Canada, respectively, by the development of the Alberta petroleum producing industry. These tables take no account of induced investment in pipelines, refineries, etc. To this extent they fail to account for the total effect. It is, however, possible, even plausible, to argue that if local production did not become available, other means would have had to be found to supply the growing petroleum products market of Ontario and Western Canada. This would undoubtedly have meant refinery and pipeline construction, but the locations would have been different.

Table 52 compares primary income generated in Canada by all industries to that generated by the Alberta petroleum producing industry. This indicates the rate at which the local income series grew, relative to the rest of the economy. It shows that the growth of this industry was one of the dynamic factors in Canada's economic growth from 1947-52, and one which was becoming of major significance for the economy as a whole.

Table 52

Private Primary Income Generation in Canada: 1947-52(17)
(Millions of Dollars)

	1947	1948	1949	1950	1951	1952
Residential Construction	506	687	742	801	781	786
Non-Residential Construction	599	818	903	1,026	1,260	1,554
New Machinery & Equipment	1,016	1,230	1,323	1,389	1,769	1,916
Inventory Changes	947	605	231	960	1,620	310
Exports	3,638	4,054	4,011	4,183	5,089	5,573
Less Imports	3,621	3,636	3,837	4,513	5,613	5,400
Total	3,085	3,708	3,373	3,846	4,906	4,739
Alberta Petroleum Industry	18.9	58.4	126.8	173.2	218.0	258.8
% of Total	0.6	1.6	3.8	4.5	4.4	5.5

Capital formation and import-export statistics for Alberta are not

(17) D.B.S. National Accounts, Income & Expenditure, 1926-1950, Ottawa 1952.
idem 1950-1956, Ottawa, 1957.

Tables 30 and 31 indicate primary income generation in Alberta and all of Canada, respectively, by the development of the Alberta petroleum producing industry. These tables take no account of induced investment in pipelines, refineries, etc. To this extent they are in account for the total effect. It is, however, possible, even plausible, to argue that if local production did not become available, other means would have had to be found to supply the growing petroleum products market of Canada and Western Canada. This would undoubtedly have meant refinery and pipeline investments, but the locations would have been different.

Table 32 compares primary income generation in Canada by all industries to that generated by the Alberta petroleum producing industry. The industries are ranked in order per local income terms, relative to the total primary income. It shows that the growth of this industry was one of the major factors in Canada's economic growth from 1957-63, and one which was a mainstay of major significance for the economy as a whole.

Table 32

Private Primary Income Generation in Canada, 1961-1963(17)
(Millions of Dollars)

	1961	1962	1963	1960	1961	1962
Residential Construction	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Non-Residential Construction	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New Industrial Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Inventory Changes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Less Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alberta Petroleum Industry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
% of Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Capital formation and import-export statistics for Alberta are not [illegible]

(17) D.B.S. National Accounts, Income and Expenditure, 1960-1963, Ottawa 1963.
Idem. 1962.
1960-1961, Ottawa, 1957.

available. Personal income statistics are, however, Table 53 compares Alberta personal incomes with primary income in the province generated by the oil industry.

Table 53

Personal Income and Primary Income Generated by the Petroleum Producing Industry: Alberta 1947-52.(18)
(Millions of Dollars)

	Personal Income	Primary Income from Petroleum Industry	%
1947	709	12.3	1.7
1948	870	46.3	5.3
1949	896	108.3	12.1
1950	921	150.7	16.4
1951	1,179	185.2	15.7
1952	1,253	223.6	17.8

The importance of this industry is well illustrated by the above Table. If account is taken of the action of the multiplier, which in Alberta is not large due to dependence on imports from other parts of Canada, it is clear that Alberta would not have shared appreciably in Canada's postwar growth without it. In fact, if account is taken of price changes, real income of Albertans would probably have dropped over the 1947-52 period. The exact contribution is difficult to determine, as other industries, notably coal mining, suffered as a result of growth in the oil and gas industry.

The gross income effect for Canada as a whole is probably much greater than for Alberta alone. Not only is primary income greater, but the multiplier is also greater, since Canada as a whole is less dependent on imports and exports than is Alberta. These leakages in Alberta tend to keep investment from having too great an effect on local G.N.P.

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(18) D.B.S. ibid, Table 27.

available. Personal income statistics are, however, lacking in company Alberta personal income was greater before 1[illegible] the province generated by the oil industry.

[illegible]

Personal Income and Income Generated by the Petroleum Producing Industry, Alberta, 1[illegible] (1[illegible])

	Personal Income	Generated Income Industry	%
	(Millions of Dollars)		
1941	700	1[illegible]	1.7
1945	810	46.9	5.[illegible]
1950	988	1[illegible]	1[illegible]
1955	811	1[illegible]	1[illegible]
1961	1,170	1[illegible]	1[illegible]
1962	1,[illegible]	1[illegible]	1[illegible]

The importance of this industry is well illustrated by the above Table. It accounts in large or [illegible] of the [illegible], which is Alberta's major line of [illegible] to Canada. It is clear that Alberta would not have [illegible] in Canada's postwar growth without it. In fact, it seems to [illegible] change. Total income of Alberta would probably have [illegible] period. The exact contribution is difficult to determine, [illegible] natural gas [illegible], initiated as a result of growth in the oil and gas industry.

The gross income effect for Canada as a whole is probably much greater than for Alberta alone. Not only is [illegible] income greater, but the multiplier is also greater. Since Canada as a whole is less dependent on [illegible] than is Alberta. These factors in Alberta tend to keep [illegible] from having too great an effect on total G.N.P.

(1[illegible]) [illegible], Table 1[illegible].

APPENDICES

INTRODUCTORY NOTE

The appendices which follow provide the underlying detail behind the aggregated estimes of Chapters 2, 3 and 5. The appendix to Chapter 2 deals with expenditure estimates, while the appendices to Chapters 3 and 5 deal with the allocation, between Sectors, of expenditures made by Sector I and Sector II, respectively. The appendices outline sources of basic data and discuss estimating techniques and problems which may affect the validity of the estimates.

Arrangement of material in the appendices is by subject, and follows the classification used in Table 3. Tables have been numbered separately in each appendix, in order to simplify references. Thus, the prefix "A2" in the designation "A2-14" indicates that this Table may be found in the appendix to Chapter 2.

Appendix to Chapter 2

Expenditure Estimates - Sector I

1. LAND ACQUISITION AND RETENTION COSTS

This is one of the best documented items of expenditure, in that a large part of the monies were paid to the Crown and are recorded in the Public Accounts. No attempt has been made to separate acquisition from retention costs, as any definition must be to some extent, arbitrary.

(a) Cost of Crown Acreage

Details of Provincial Government receipts are recorded in the Public Accounts, on the basis of the Province's fiscal year which ends March 31. As there is no means of determining the flow of receipts over the fiscal year, figures were not adjusted but were used for the calendar year most closely approximating the relevant fiscal year, i.e., 1948 calendar year statistics shown in this study really represent receipts for the fiscal year ending March 31, 1949.

National Parks are not open for oil or gas exploration and receipts for Indian reserve leases are believed to have been insignificant for the period under review, so no payments for Federally-owned acreage are considered.

Table A2-1 shows the categories of receipts shown in the Public Accounts of Alberta which have been included in "Land Acquisition and Retention Costs".

Table A2-1

Government of Alberta

Bonus and Rental Payments Received for Petroleum and Natural Gas Leases and Reservations
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
P&NG Act - Fees and Rentals	768	2,150	5,741	9,035	14,135	18,236
Purchase Price for P&NG Leases	-	8,721	23,181	28,008	12,518	19,659
Miscellaneous	32	50	79	113	62	115
Total	800	10,921	28,941	37,156	26,735	38,010

Source: Province of Alberta, Public Accounts, for fiscal years ending March 31, 1948, to March 31, 1953.

(b) C. P. R. Acreage

The Canadian Pacific Railway's income from oil and gas properties was, for this period, substantially all derived from properties in Alberta. Receipts on Land Surplus Account are shown separately in most of the Company's Annual Reports for the years from 1949 onward. Receipts for the other years have been estimated on the basis of those years for which receipts are known. The company's credits to land surplus include not only rentals but royalties which are considered separately in this study. Sufficient other information is given in the reports to permit a split to be made by valuing royalty oil. Table A2-2 shows details of the calculation.

Table A2-1

Government of Alberta

Bonus and Rental Payments Received for Petroleum and Natural Gas Leases and Reservations
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
PNGCL Act - Free and Rentals	723	4,190	5,741	5,055	14,132	18,477
Purchase Price for PNGCL Leases	-	6,721	23,101	22,000	13,818	16,837
Miscellaneous	22	30	19	113	82	118
Total	800	4,921	29,861	27,155	28,132	35,012

Source: Province of Alberta, Public Accounts, for fiscal years ending March 31, 1948, to March 31, 1952.

(b) C. P. R. Acreage

The Canadian Pacific Railway's income from oil and gas properties was, for this period, substantially all derived from properties in Alberta. Receipts on Land Surplus Account are shown separately in most of the Company's Annual Reports for the years from 1947 onward. Receipts for the other years have been estimated on the basis of those years for which receipts are known. The company's profits in land surplus include not only rentals but royalties which are considered separately in this study. Additional other information is given in the reports to permit a split to be made by valuing royalty oil. Table A2-2 shows details of the calculation.

Table A2-2

Canadian Pacific Railway

Petroleum Rents, Royalties and Reservation Fees.

Year	Total Receipts $ '000	Production from C.P.R. Leases - MM bbls.	Royalty ($12\frac{1}{2}$%) M bbls.	Royalty $ '000	Rents and Reservation Fees $ '000
1947	800x	N.A.	-	200x	600x
1948	1,196	N.A.	-	496x	700x
1949	1,711	N.A.	-	911x	800x
1950	1,965	N.A.	-	1,065x	900x
1951	2,186	3.7	472	1,230x	956x
1952	3,600x	6.3	786	2,045x	1,555x

N.B. "x" denotes figures estimated on the basis of data appearing in the Company's reports, from which the other figures were taken directly.

(c) C.N.R. Acreage

The Crown company's financial statements are not nearly as informative in this respect as the C.P.R.'s. However, the C.N.R. has much smaller holdings in the productive areas of Alberta, and most of its mineral holdings are in other provinces. On the basis of this rather sketchy information and examination of the items in the Company's income statement which should include these revenues, they are estimated in Table A2-3. While these statements are doubtless inaccurate, the overall total of lands' costs would not seriously be affected if the total were several times as great.

Table A2-4

Canadian Pacific Railway

Corporation Taxes, Royalties and Reservation Fees.

Year	Total Revenue $ 000	Production from C.P.R. Lands - Net Sales	Royalty (12½%) of Sales $ 000	Royalty Fees $ 000	Home-Land Reservation Fees $ 000
1947	2,[illegible]	N.A.	-	200x	[illegible]
1948	[illegible]	N.A.	-	480x	700x
1949	[illegible],711	N.A.	-	911x	800x
1950	1,[illegible]	N.A.	-	1,065x	900x
1951	[illegible]	[illegible]	474	1,280x	[illegible]
1952	3,000x	N.A.	766	2,052x	1,336x

N.B. "x" denotes figures estimated on the basis of data appearing in the Company's reports, from which counterpart figures were taken directly.

(a) C.N.R. Acreage.

The Crown company's financial arrangements are not nearly as informative in this respect as the C.P.R.'s. Nevertheless the C.N.R. has much smaller holdings in the productive areas of Alberta, and most of its mineral holdings are in other provinces. On the basis of this rather sketchy information and examination of the items in the Company's income statement which should include these revenues, they are estimated in Table A2-5. While these estimates are definitely inconclusive, the overall total of lands' costs would not seriously be affected if the total were several times as great.

Table A2-3

Canadian National Railways

Receipts from Petroleum Lease Rentals and Reservation Fees.

Year	$ '000
1947	50
1948	100
1949	150
1950	200
1951	250
1952	300

Source: Estimated from data appearing in the Company's annual reports.

(d) C. and E. Corporation Acreage

The Calgary and Edmonton Corporation Limited owns, in fee simple, the mineral rights on 1,142,143 acres of land formerly owned by its predecessor companies. The Company started at an early date to lease these rights to other companies and to participate in the development thereof. For the purposes of this study, it has been assumed that these rights were free to the operating companies, as intercompany payments within Sector I do not affect our estimates of expenditures. Similar treatment has been given mineral rights owned by smaller, similar companies such as Security Freehold Petroleums Ltd.

(e) Hudson's Bay Company Acreage

The Hudson's Bay Company shows its annual earnings from royalties and rentals in its annual report. As stated in Table 4, it owns the mineral rights on some 2.4 million acres in Alberta. The Hudson's Bay Company also has an affiliate - Hudson's Bay Oil and Gas Co. Ltd. - which is a pro-

Table [illegible]

Canadian Petroleum Companies

Dividends from Distributable Earnings and Investment Income

Year	$ [illegible]
1917	[illegible]
1920	[illegible]
1925	[illegible]
1930	[illegible]
1931	[illegible]
1932	[illegible]

Source: Tabulated from data appearing in the Company's annual reports.

(b) [illegible], and K. Corporation Average.

The Calgary and Edmonton Corporation Limited case, in [illegible], the mineral rights on [illegible] acres of land in Alberta, owned by the parent company [illegible]. The Company [illegible] rights to other companies [illegible]. For the purposes of this study it should be assumed that these rights were [illegible] the corresponding companies, so that [illegible] payments which hence I [illegible] affect our estimates of expenditures. Similar treatment has been given [illegible] eral rights owned by smaller, similar companies such as Security Freehold Petroleum Ltd.

(c) Hudson's Bay Company Average.

The Hudson's Bay Company reviews its annual earnings in [illegible] and results in an annual report. As stated in Table [illegible], it owns the mineral rights on some 2.4 million acres in Alberta. The Hudson's Bay Company also has subsidiaries - Hudson's Bay Oil and Gas Co. Ltd., which is a pure-

ducing company. During the period 1947-52, it was owned 25% by the Hudson's Bay Company and 75% by the Continental Oil Co. of Delaware.

Hudson's Bay Company mineral rights are held by the parent company, not be the affiliate. An estimated allocation of receipts between royalties and rentals, based on receipts by other mineral owners, appears in Table A2-4.

Table A2-4

Hudson's Bay Company

Receipts from Oil and Gas Development

Year	Royalties and Rentals - £	Conversion Rate	Royalties and Rentals - $	Estimated Royalties	Estimated Rentals
1947	-	-	100,000x	70,000x	30,000x
1948	-	-	150,000x	100,000x	50,000x
1949	-	-	250,000x	170,000x	80,000x
1950	-	-	320,000x	220,000x	100,000x
1951	142,258	2.94	408,000	288,000x	120,000x
1952	198,439	2.80	555,000	405,000x	150,000x

Source: 1951-52, the Company's annual reports. Earlier years and the breakdown between rentals and royalties were estimated by the author and are indicated by an "x".

(f) Other Freehold Acreage

The other 600,000 acres of potentially petroliferous mineral rights within the province belong largely to individuals. A large portion of these lands lies in the general Edmonton area or along a line joining Calgary and Edmonton. Substantially higher returns were received by those mineral owners with freehold rights in "hot" areas than by corporate owners as, in most cases, bonuses were paid for signing leases, while corporate owners

[illegible]

mining company. During the period 1921-22, it was owned 50% by the Dominion Gas Company and 50% by the Dominion Oil Co. or Dielstrare.

Dominion Gas Company mineral claims are held by the parent company not by the affiliate. An estimated allocation of costs between royalties and rentals, but not for holdings by other mineral owners, appears in Table 42-1.

Table 42-1

Dominion Gas Company

Royalties from Oil and Gas Development

Year	Royalties and Rentals - $	Conversion Rate	Royalties and Rentals - $	Estimated Royalties	Estimated Rentals
1917	-	-	[illegible]	10,000x	30,000x
1918	-	-	[illegible]	[illegible]	[illegible]
1919	-	-	[illegible]	[illegible]	[illegible]
1920	-	-	[illegible]	[illegible]	[illegible]
1921	147,594	[illegible]	[illegible]	[illegible]	[illegible]
1922	190,458	[illegible]	[illegible]	[illegible]	[illegible]

Source: 1921-22, the Company's annual reports. Earlier years and the non-affiliate Dielstrare rentals and royalties were estimated by the author and are indicated by an x.

(f) Other Freehold Acreage

The other 490,000 acres of potentially petroleiferous mineral rights which the provinces belong largely to individuals. A large portion of these lands lies in the general Edmonton area or along a line joining Calgary and Edmonton. Substantially higher returns were received by those mineral owners with freehold rights in "oil" zones than by corporate owners as, in most cases, bonuses were paid for signing leases, more corporate owners

were usually content to turn over their acreage to operators for a nominal rental. While no details of amounts paid to individuals are available, total acreage holdings are known, and by comparison with holdings of the Crown and corporate mineral owners, it is possible to estimate their magnitude. Such an estimate appears in table A2-5

Table A2-5

Estimated Acquisition and Retention Costs - Freehold Acreage

Alberta, 1947 - 52

(thousands of Dollars)

1947	200
1948	500
1949	800
1950	800
1951	900
1952	1,000

Summary re Land Acquisition and Retention Costs

Table A2-6 summarizes the estimates of land acquisition and retention costs appearing in Tables A2-1 to A2-5 inclusive. While many of the estimates for smaller mineral owners are to some extent questionable, the Crown figures are firmly documented and form such a large part of the total that any error in the others is not particularly significant. It should be noted at this time that these costs are for mineral rights only and do not include surface rentals paid on producing leases, which are included in operating costs.

were usually confined to one or two years, perhaps to coincide with for a nuclical crisis. While no analysis of economic yield to individuals are available, total workers holdings are [illegible] on a comparison with holdings of the Crown and corporate [illegible] income, it is possible to estimate that [illegible] upon an estimate appears in table 43-2

Table [illegible]

Calculated Installment and Retention Costs - Financial Interest

(Constant Dollars - [illegible])

	(Thousands)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Summary of Land Acquisition and Retention Costs

Table 43-2 summarizes the estimates of land acquisition and retention costs appearing in Tables [illegible] - [illegible] inclusive. While many of the estimates for smaller general [illegible] are in some sense questionable, the Crown figures are fairly [illegible] and form quite a large part of the total and are [illegible] in the [illegible] in our particularly significant. It should be noted at this time that these costs are for [illegible] alone and do not include surface rights and [illegible] costs, which are included in operating costs.

Table A2-6

Summary of Land Acquisition and Retention Costs, Alberta Petroleum Industry, 1947 - 52

(thousands of Dollars)

Type of Rights	1947	1948	1949	1950	1951	1952
Crown	800	10,921	28,941	37,156	26,735	38,010
C.P.R.	600	700	800	900	956	1,555
C.N.R.	50	100	150	200	250	300
H.B.C.	30	50	80	100	120	150
Other Freehold	200	500	800	800	900	1,000
TOTAL:	1,680	12,271	30,771	39,156	28,961	41,015

Source : See Table A2-1 and A2-5.

2. COST OF GEOLOGICAL AND GEOPHYSICAL SURVEYS.

While the date published on this type of expenditure are incomplete a quite realistic picture can be pieced together from the available information.

(a) Estimates of Physical Activity - Geophysical

Several series of figures have been published which indicate the level of geophysical operations in Western Canada or in Alberta during the period under review. Four of these series are listed in Table A2-7, as published, with no adjustment for the crews which may have operated in provinces other than Alberta. In addition, various publications, such as the "Daily Oil Bulletin" and "Oil in Canada" have from time to time published surveys showing the number and location of crews operating in the Basin. These are not shown in this study, but confirm the series used. The Provincial Bureau of Statistics series purports to show "crews operating" but does not state whether this is in the peak number during the year, the average number, a mid-year or

[illegible]

Summary of Liquor Production and Inventory [illegible]
[illegible] Fiscal Years [illegible] - 19[illegible]

(Thousands of Dollars)

Area or Items	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C.P.S.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C.P.S.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C.P.S.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Provinces	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTALS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Source: See Tables [illegible] and [illegible].

[illegible] COST OF [illegible] AND [illegible] SERVICES

While the data presented on this type of accounting are incomplete, a quite reasonable picture can be pieced together from the available information.

(a) [illegible] of Liquor Activity - Description

Liquor sales in Ontario have been [illegible] since [illegible]. The level of production operations in Ontario (Crown or C.P.S.) during the period were [illegible]. Some of these details are listed in Table [illegible]. As indicated, only an estimated [illegible] the Crown might have operated in previous years [illegible]. In addition, [illegible] publications, such as the "Daily [illegible] Bulletin" and "[illegible] Canada" have alluded to these political pressures [illegible] the number and location of stores operating in the Province. These are not [illegible] in this study, but [illegible] the series used. The Provincial Bureau of Statistics [illegible] provide to show "stores operating" but [illegible] the peak number during the year, the average number, a [illegible] of

year-end figure, or merely the number of crews which held permits and worked in the province at some time during the year. Examination of the figures suggests the last interpretation.

Most of these estimates were made by actual count, i.e., by surveys of operators and contracting companies, and are all probably more or less incomplete due to omissions. The largest figure is therefore likely to be the most reliable. The Canadian Petroleum Association statistics do not contain any estimate of the amount of aerial magnetometer work done. The estimates of Table A2-8 were used for preparing the cost figures used in this study. They were prepared on the basis of the series appearing in Table A2-7. Magnetometer operations were estimated from certain published data (5)

Table A2-7

Geophysical Operations in Western Canada

Year	Source (1)	(2)	(3)	(4)
1947	-	210	22	199
1948	528	540	65	492 CM
1949	1,027	900	77	68 - 89 crews
1950	1,173	1,300	105	86 - 87 crews
1951	1,413	1,630	130	106 - 120 crews
1952	1,537	2,181	142	126 - 127 crews

Sources

(1) Crew months, Alberta only, Canadian Petroleum Association Statistical Bulletin Fall, 1955, Data stated incomplete. Does not include magnetometer parties.
(2) Crew months, Western Canada, Oil in Canada, Nov. 3 1952 and July 27, 1953.
(3) "Crews". Provincial Bureau of Statistics.
(4) Alberta, A.A.P.G. Bulletin, various issues - mid-year and year-end figures shown for 1949-52, 1947 figures are for Western Canada.
(5) 1951 and 1952 taken from "Seismic Crew at Work" Oil in Canada July 27, 1953, P.34. Other years estimated on the basis of C.P.A. Cost figures.

Year-end figure, or merely inventories of seeds being held

permits and worked in the province at some time during the year.

Examination of the figures indicates that not all are representative.

Most of these estimates were made by annual crop, [illegible]

surveys of operators and contractors concerned, and are [illegible]

more or less inaccurate due to omissions. The largest figure is

therefore likely to be the most reliable. The Canadian Petroleum

Association statistics do not include any estimate of the amount of seismic

exploration work done. The estimates of Table 42-8 were used for

preparing the cost figures used in this study. They were prepared on

the basis of the service companies at Table 42-7. Magnetometer operations

were estimated from service publicity data (4).

Table 42-8

Geophysical Operations in Western Canada

Year	Crews (1)	Crews (2)	Crews (3)	Crews (4)
1947	-	316	16	1,20
1948	.529	440	35	900 - 1,000
1949	1,047	480	47	81 - 90 crews
1950	1,170	1,300	142	90 - 97 crews
1951	1,313	1,400	150	100 - 110 crews
1952	1,347	2,141	142	120 - 127 crews

Sources:

(1) Crew months, Alberta only, Canadian Petroleum Association Statistical Bulletin "A", 1954. This which included incentives. Does not include magnetometer parties.

(2) Crew months, Western Canada, Oil in Canada, Nov. 3 1952 and July 27, 1953.

(3) "Crews", Provincial Bureau of Statistics.

(4) Alberta, A.P.C.O. bulletin, various issues - mid-year and year-end figures shown for 1949-1951. 1947 figures are for Western Canada.

(5) 1951 and 1952 taken from "Drilling Crew at Work" Oil and Gas Journal July 27, 1953, P.54. These years included in the basis of the Cost figures.

Table A2-8

Estimated Geophysical Operations in Alberta, by Types

(Crew months)

Year	Seismograph	Gravity-meter	Magnetometer	Total
1947	150	43	7	200
1948	400	95	4	499
1949	888	139	4	1,031
1950	1,051	122	17	1,140
1951	1,294	119	13	1,420
1952	1,440	97	8	1,545

(b) Estimated Expenditures - Geophysical

Cost experience for geophysical operations is not as well-documented as land or even drilling costs. However, sufficient data has been published to allow estimating total costs and their composition with a reasonable degree of accuracy. The only complete series of costs published is the Canadian Petroleum Association's estimate, but other figures, published from time to time, offer corroboration. The Provincial Bureau of Statistics' figures purport to represent the total expenditures made by the industry. On a crew-month basis, they appear to conflict with one another for the available years. It would appear that imprecise definitions on the questionnaire resulted in different interpretations being used by the different operators and improper inclusion of other expenditure. under the heading "exploration." This unfortunately casts doubt on the reliability of the Provincial Bureau's expenditure figures, and they have been used only where corroborated by other evidence. Since the 1951-52 questionnaire this condition has been largely remedied and future figures will doubtless be more reliable. Table A2-9 lists the estimated unit costs which were used in the preparation of cost estimates for this study. The Canadian Petroleum Association series is the only one which gives a breakdown for all types of operations.

Table A1-4

Estimated Geological Operations in Canada, by Years
(Thousands)

Year	Exploration	Gravity-Magnetic	Seismograph	Total
1947	116	46	7	169
1948	404	82	4	492
1949	688	120	4	1,012
1950	1,051	102	17	1,170
1951	1,284	116	16	1,416
1952	1,346	97	8	1,451

(b) Estimated Expenditures - (Thousands)

Data coverage for geological activities is not as well documented as that of their drilling cousin. However, sufficient data has been available to allow calculating total costs and their components with a reasonable degree of accuracy. The data sources and details of work outlined in the Canadian Petroleum Association's publication, Ten Year Figures, published from time to time, have corroboration. The Provincial Series of Detailed Figures Report is reported the total expenditures made by the industry, on a year-to-year basis, but appear to contain also one another for the available years. It would appear that inclusions additions on the questionnaire resulted in different interpretations being made by the different operators and therefore between of other expenditures under the heading "exploration." This inconsistent issue made, at the reliability of the Provincial Detailed expenditure figures, and they have been also duly taken corrections in other evidence. Since the 1950-52 conditions the condition has been largely remedied and future figures will correspond by some validity. Table 1 shows the estimated and total which were used in the preparation of cost estimates for this study. The Canadian Petroleum Association series is the only one which gives a breakdown for all types of operations.

The unit costs of Table A2-10 were combined with the activity estimates of Table A2-8 to calculate total expenditures as shown in Table A2-11.

Table A2-9

Estimated Geophysical Unit Costs, Alberta, 1947-52

Year	Cost per Crew Month (1) Seismic	(1) Gravity	(2)	Others
1947	-	-	-	-
1948	18,000	4,550	-	20,000 (3)
1949	18,000	5,750	-	-
1950	20,000	4,900	-	50,000 (4)
1951	24,000	5,050	32,700	
1952	25,000	6,200		16,450(5)25,000 (6) 17,000(7)29,000 (8)

Sources :

(1) Calculated from expenditure statistics appearing in the Fall, 1955 Statistical Bulletin of the Canadian Petroleum Association.

(2) Calculated from data appearing in the Provincial Bureau of Statistics Report.

(3) For winter seismic operations, E.J. Handley, "Seismograph Surveying In Central Alberta" World Oil (June 1948), p. 216

(4) For air-borne magnetometer. T.M. C'Malley, "Alberta Flying Magnetometer Survey Completed" World Oil, May 1951, p.235.

(5) Average of all types. World Oil, Feb. 1952, p. 236.

(6) Seismic Crew in Northern Alberta bush. James Joseph, "20 Days in and 10 days out" World Oil, Sept. 1952, p.290.

(7) Seismic party on the prairies. Oil in Canada, July 27, 1953. p.36

(8) Seismic party, bush operations, idem.

The unit costs of Table A3-4 were computed with the activity assumptions of Table A3-1 in calculating total expenditures as shown in Table A3-5.

TABLE A3-4

Estimated Unit Costs (Capital Amortization Included)

Year	(1) Schools	(2) Other Uses	(3) Total Costs
1947	[illegible]	[illegible]	[illegible]
1948	[illegible]	[illegible]	[illegible]
1949	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]
1952	[illegible]	[illegible]	[illegible]

Sources:

(1) Calculated from upon figures available [illegible] Commission [illegible] of the Coastal Conservation Association.

(2) Calculated from data appearing in the [illegible] Report [illegible].

(3) [illegible] Water Board [illegible] Conserving [illegible] in Coastal Alabama" [illegible] 1952, p. [illegible].

(4) [illegible] Report [illegible] Alabama [illegible] Survey [illegible] Report [illegible] 1952, p. [illegible].

(5) Average of all types [illegible] Inc.

(6) Sample Cost in Northern Alabama [illegible] "[illegible] in and 10 days [illegible] Co., [illegible] 1952, p. [illegible].

(7) Estimate partly on the basis of [illegible] May 27, 1953, p. [illegible]

(8) Estimate partly from [illegible].

Table A2-10

Geophysical Unit Costs used for Cost Estimates.

($ per crew month)

Year	Seismic	Gravity	Magnetometer
1947	15,000	4,000	50,000
1948	18,000	4,500	50,000
1949	19,000	5,000	50,000
1950	20,000	5,000	50,000
1951	24,000	5,000	60,000
1952	25,000	6,000	60,000

Source: Estimated on the basis of Data in Table A2-9.

Table A2-11

Estimated Geophysical Costs , Alberta 1947 - 52

(Thousands of Dollars)

Year	Seismic	Gravity	Magnetometer	Total
1947	2,250	172	350	2,772
1948	7,200	430	200	7,830
1949	16,880	695	200	17,775
1950	21,020	610	850	22,480
1951	31,000	595	780	32,375
1952	36,000	580	480	37,060

Source : Calculated from data in Tables A2-8 and A2-10

(c) Geological operations and expenditures

Much less detailed publicity has been given geological surveying operations than geophysical. However, an estimate of the total geological activity has been published and this has been separated between surface parties and structure test drilling on the basis of other published figures. Estimates of geological activity by types are listed in Table A2-12. These have been used in preparing the cost estimates shown in Table A2-13.

Table A2-12

Geological Surveys, Alberta, 1947 - 1952
(crew months)

Year	Surface Parties	Structure-Test Drilling	Total (I)
1947	43 (2)	6 (2)	49
1948	54 (2)	41 (2)	95
1949	70	81	151
1950	80	211	291
1951	100 (3)	377	477
1952	120	380	500

Sources:

(1) Total figures estimated from figures appearing in Oil in Canada, Nov. 3, 1952 for the years 1947-51.

(2) Breakdown estimated from L.G. Weeks "Developments in Foreign Fields", A.A. P.G. Bulletin, June 1948 p.1100 and June 1949 p.1040

(3) Surface party operations estimated from data in A.J. Goodman, "Developments in Western Canada in 1951" A.A.P.G. Bulletin June 1952, p.1260

It is estimated that structure testing drilling crews cost about $12,000.00 per month to keep in the field (I). This figure is the basis of the cost estimate used in this study.

Surface geological parties range in size from small affairs consisting of two men and a mule to more elaborately staffed safaris supplied by airplane and helicopter. Both these types are in a minority, however, and the typical party is composed of four or five men and costs some $5,000.00 per month to operate.

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(1) While no data on structure test drilling costs in Canada appears to have been published, this average figure is an estimate based on the relative complexity of their operation compared with that of seismic crews which employ similar drilling equipment, but pay higher costs for complex electronic equipment and larger crews.

Table Table-12

Geophysical Operations, Offshore Canada
(Crew Months)

Year	Surface Parties	Stationary and Shooting	Total (1)
1947	42 (2)	[illegible] (2)	[illegible]
1948	54 (2)	[illegible] (2)	[illegible]
1949	70	81	[illegible]
1950	80	111	191
1951	100 (2)	171	271
1952	130	169	299

Sources:

(1) Total figures estimated from Canada approaching in Oil in Canada, Nov. 3, 1952 for the years 1947-51.

(2) Breakdown estimated from L.C. Weeks "Geophysicists in Foreign Fields", A.A. P.G. Bulletin, June 1949 p.1100 and June 1950 p.1044

(3) Surface party operations estimated from data in A.J. Goodman, "Developments in Western Canada" [illegible] A.A.P.G. Bulletin June 1952, p.1290

It is estimated that stationary shooting operations crews cost about $15,000.00 per month to keep in the field (1). Multiplying this by the basis of the cost estimate used in this study.

Surface geological parties range in size from small affairs consisting of two men and a mule to such elaborately equipped outfits supplied by airplane and helicopter. Both these types are in a minority, however, and the typical party is manned of four or five men and costs some $5,000.00 per month to operate.

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(1) While no data on structure test drilling costs in Canada appears to have been published, this average figure is an estimate based on the relative complexity of drilling programmes compared with that of seismic crews which employ similar drilling equipment, but pay higher rates for complex electrical equipment and larger crews.

Estimated costs of conducting geological surveys in Alberta during the period under review are shown in Table A2-13.

Table A2-13

Cost of Geological Surveys, Alberta, 1947-52

(Thousands of Dollars)

Year	Surface Parties	Structure-Test Drilling.	Total.
1947	215	72	287
1948	270	492	762
1949	350	972	1,322
1950	400	2,532	2,932
1951	500	4,524	5,024
1952	600	4,564	5,160

Source: Estimated from the figures in Table A2-12 and unit cost estimates mentioned in the text.

(d) Supervisory Costs

Most companies have geological and geophysical staffs which coordinate the operations of field staffs and analyze and correlate their findings. No figure for the cost of such supervision has been published. It has been calculated at a flat rate of 10% of direct survey costs.

A summary of survey costs is contained in Table A2-14

3. EXPLORATORY DRILLING

Several series of statistics of exploratory drilling have been published. They are inconsistent with one another, usually as a result of differences of opinion as to what constitutes an exploratory well. For the years 1948 - 1952, we have used the annual statistics on exploratory drilling published by the American Association of Petroleum Geologists. Conservation Board figures were used for 1947. Changed

Estimated costs of geological and geophysical surveys in Alberta during the period under review are shown in Table A2-12.

Table A2-12

Cost of Geological Surveys, Alberta, 1947-52

(Thousands of dollars)

Year	Surface Survey	Aerial Survey	Total
1947	314	13	327
1948	390	452	842
1949	356	970	1,326
1950	400	2,522	2,922
1951	500	4,624	5,124
1952	440	4,720	5,160

Source: Estimated from the figures in Table A2-13 and non-oil estimates mentioned in the text.

(d) Supervisory Costs

Most companies have geological and geophysical staffs which coordinate the operations of their crews and engineers and correlate their findings. No figure for the cost of such supervision has been published. It has been calculated at a flat rate of 10% of direct survey costs.

A summary of survey costs is contained in Table A2-14

3. EXPLORATORY DRILLING

Several series of statistics of exploratory drilling have been published. They are inconsistent with one another, mainly as a result of differences of opinion as to what constitutes an exploratory well. For the years 1948 - 1951, we have used the annual statistics on exploratory drilling published by the Alberta Association of Petroleum Geologists. Conservation Board figures were used for 1947. Changed

Table A2-14

Estimated Costs of Petroleum Surveys: Alberta - 1947-52.
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
A. GEOPHYSICAL						
1. Seismic	2,250	7,200	16,880	21,020	31,000	36,000
2. Gravimetric	172	430	695	610	595	580
3. Magnetometric	350	200	200	850	780	480
Sub Total	2,772	7,830	17,775	22,480	32,375	37,060
B. GEOLOGICAL						
1. Surface Parties	215	270	350	400	500	600
2. Structure Test Drilling	72	492	972	2,532	4,524	4,560
Sub Total	287	762	1,322	2,932	5,024	5,160
Total Direct	3,059	8,392	19,097	25,412	37,399	42,220
C. INDIRECT	306	858	1,908	2,543	3,741	4,220
Total Cost of Surveys	3,365	9,450	21,005	27,955	41,140	46,440

TABLE [illegible]

Estimated Costs of Evaluation Survey of Alberta - 1969-[illegible]
(Thousands of Dollars)

A. GEOPHYSICAL	1967	1968	1969	1970	1971	1972
1. Seismic	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. Gravimetric	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. Magnetometric	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sub Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. GEOLOGICAL						
1. Surface Mapping	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. Structure Test Drilling	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sub Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total (A+B)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C. OVERHEAD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Cost of Survey	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

definitions do not affect our overall cost estimates appreciably, merely its allocation between exploration and development. Total footage figures were obtained from the Conservation Board. Drilling Statistics used are shown in Table A2-15.

Table A2-15

Footage Drilled in Alberta

(Thousands of Feet)

Year	Exploratory	Development	Total
1947	336	546	882
1948	611	973	1,584
1949	1,081	2,132	3,213
1950	1,114	3,216	4,330
1951	1,692	3,870	5,562
1952	2,366	4,266	6,632

Source - Total - Petroleum and Natural Gas Convervation Board, Alberta Oil and Gas Industry, 1947 - 52 (annual volumes)

Exploratory - Lahee F.H. in A.A.P.G. Bulletin 1948-1953 (June issues)

definitions do not affect the overall coal estimates appreciably, merely the allocation between exploration and development. Total footage figures were obtained from the Conservation Board. Drilling statistics used are shown in Table A4-12.

Table A4-12

Footage Drilled in Alberta

(Thousands of Feet)

Year	Exploratory	Development	Total
1947	385	533	918
1948	611	975	1,587
1949	1,081	2,124	3,205
1950	1,114	3,311	4,425
1951	1,895	3,670	5,565
1952	2,308	4,158	6,466

Source - Total - Petroleum and Natural Gas Conservation Board, Alberta Oil and Gas Industry, 1957 - 58 (annual volumes)

Exploratory - Lairs P.M. in A.A.P.G. Bulletin 38:2,1954

(June issue)

Unit drilling costs are based on an average cost derived from the P.B.S. reports (1) while the D.B.S. series (2) was used for the breakdown of these cost estimates between sectors as shown in the appendix to a later chapter. Table A2-16 summarizes the cost data used in preparing the averages used for this study. While exploratory wells are usually more costly on a per foot basis than

Table A2-16

Drilling Costs in Alberta 1951 - 54

Year	Footage Drilled	Total Drilling Cost	Per Foot
1951	5,562,665	76,317,625	13.70
1952	6,631,529	101,179,272	15.30
1953	6,422,889	88,723,816	13.82
1954	5,674,759	86,235,688	15.20
	24,291,842	352,456,401	14.53

development wells, owing to the more extensive coring and testing programs needed to evaluate prospective geological horizons penetrated by the drill, the difference is not great enough to affect our estimates materially. Table A2-17 summarizes the cost estimates used for this study, both exploratory and development.

Table A2-17

Estimated Drilling Costs, Alberta 1947 - 52

(Thousands of Dollars)

Year	Exploratory	Development	Total
1947	4,880	7,940	12,820
1948	8,890	14,140	23,030
1949	15,710	31,000	46,710
1950	16,200	46,700	62,900
1951	24,600	56,200	80,800
1952	34,400	62,050	96,450

(1) Employment Statistics and Expenditures in the Alberta Oil and Gas Industry, 1951-1954

(2) Contract Drilling in the mining industry, annual volumes ,1947-52,

The drilling costs are based on an average cost received from the U.S.S. Bureau of Mines (1) which is was used for the development of Shell's test producing wells as given in the appendix to a later analysis. Table A-4-4 summarizes the cost data used in preparing the Strategic Model for this study. While exploratory wells are usually more costly, a pilot test shows that development wells, owing to the more economic methods and benefits of drilling based on reliable prospective geological information obtained by the drill, the difference is not great. Drilling activities are summarized. Table A-4-7 summarizes the cost estimates used for this study, and particularly the development.

Table A-4-4

Drilling Costs in Alberta, 1951 - 53

Year	Exploratory Drilling	Total Drilling Cost	Per Foot
1951	2,457,000	78,017,400	3.77
1952	2,801,326	101,176,270	14.00
1953	2,415,170	69,570,069	13.00
1954	2,979,770	82,394,780	14.00
	10,651,466	332,157,419	14.42

Table A-4-5

Estimated Drilling Costs, Alberta 1951 - 54

Year	Exploratory	Development	Total
	(Thousands of Dollars)		
1947	1,400	7,400	13,750
1948	2,500	2,100	10,400
1949	10,700	21,000	41,110
1950	12,400	47,700	73,000
1951	24,000	76,300	96,000
1952	14,400	72,000	86,400

(1) Exploration Statistics and Expenditures in the Alberta Oil and Gas Industry, 1951-1954.

(2) Current Drilling in the Alberta Industry, annual volume, 1947-54.

We have made no allowance for any change in per foot drilling costs over the period. Available evidence is fragmentary and contradictory. While the cost of labour and materials has risen, increases in efficiency due to higher penetration rates, more economical casing programs, etc. appear to have held costs nearly constant over the period.

(5) DEVELOPMENT DRILLING COSTS

Development wells may be defined as those wells necessary to develop a pool after it has been found.

Development drilling costs have been calculated on the same basis as exploratory drilling costs, namely, by applying an average cost per foot to the statistics of footage drilled. There calculations are also shown in Table A2-17.

(6) PUMPING AND LEASE EQUIPMENT COSTS.

The basic equipment installed on all producing leases in Alberta is quite similar except that not all wells are equipped with pumps. Average cost of wellhead and lease installations was estimated as shown in Table A2-18 after consulting available references and industry sources.

Table A2-18

Estimated Pumping and Lease Equipment Costs for an Average Well in Alberta.

	$ per oil well	$ per gas Well
1947	12,300	1,000
1948	13,900	1,100
1949	14,000	1,200
1950	15,000	1,300
1951	16,200	1,400
1952	16,400	1,500

We have found no allowance for, say, drilling in Precambrian lying deep over the period. Available evidence is fragmentary and contradictory. While the cost of labour and materials has risen, increases in efficiency due to higher penetration rates, improved economical casing programs, etc. appear to have held costs reasonably constant over the period.

(3) DEVELOPMENT DRILLING COSTS

Development wells may be defined as those wells necessary to develop a pool after it has been found.

Development drilling costs have been calculated on the same basis as exploratory drilling costs, namely, by multiplying average cost per foot by the statistics of footage drilled. These calculations are also shown in Table A2-17.

(4) PRODUCING AND LEASE EQUIPMENT COSTS

The basic equipment is similar in all producing areas in Alberta in the sense that not all wells are equipped with pumps. Average cost of wellhead and lease installations was estimated as shown in Table A2-18 after consulting available references and industry sources.

Table A2-18

Estimated Producing and Lease Equipment Costs for an Average Well in Alberta

	$ per oil well	$ per gas well
1947	13,300	1,200
1948	13,800	1,400
1949	14,000	1,500
1950	15,000	1,300
1951	15,200	1,400
1952	15,400	1,600

Table A2-19

COST OF PUMPING AND LEASE EQUIPMENT

ALBERTA 1947 - 1952

Year	New Oil Wells Completed	Cost per Oil Well	Cost for Oil Wells	New Gas Wells Completed	Cost per Gas Well	Cost for Gas Wells	Total Cost.
		$	SM		$	$M	$M
1947	107	12,300	1,316	36	1,000	36	1,352
1948	217	13,900	3,016	22	1,100	24	3,040
1949	540	14,000	7,560	35	1,200	42	7,602
1950	753	15,000	11,295	40	1,300	52	11,347
1951	763	16,200	12,360	115	1,400	161	12,521
1952	946	16,400	15,514	154	1,500	231	15,745
			51,061			546	51,607

Table A-3.10

COST OF DRILLING AND DEVELOPMENT

ALBERTA 1947 - 1959

Year	New Oil Wells Completed	Cost per Oil Well	Cost per Oil Well	New Gas Wells Completed	Cost per Gas Well	Cost per Gas Well	Total Costs
		$	$M		$	$M	$M
1947	107	13,800	1,476	10	1,000	10	1,486
1948	347	14,500	5,034	32	1,100	34	5,068
1949	344	14,000	4,816	38	1,200	46	4,862
1950	783	14,000	11,376	46	1,200	55	11,431
1951	782	14,200	11,104	102	1,300	133	11,237
1952	944	14,500	13,688	104	1,300	134	13,822
			46,504			412	46,916

Since some exploratory wells become producers, and, conversely, a percentage of development wells are dry holes, we have not relied on our statistics of exploratory and development drilling but have used the Conservation Board's statistics of successful completions in preparing the equipment cost estimates shown in Table A2-19.

(9) OTHER DEVELOPMENT COSTS

Data on the diverse construction included under this title is virtually non-existent. The cost is, however, roughly proportional to the rate of development and a flat charge per successful well completed has been included. This figure is an estimate dropping from year to year which appears reasonable in the light of what references to it are available.

The resulting estimates are shown in Table A2-20

Table A2-20

Other Development Costs - Alberta 1947-52

Year	Completions Oil	Completions Gas	Total Successful	Cost Per Unit	Annual Cost
1947	107	36	143	$ 5,000	$ 715,000
1948	217	22	231	5,000	1,195,000
1949	540	35	575	4,000	2,300,000
1950	753	40	793	3,000	2,379,000
1951	763	115	878	2,800	2,460,000
1952	946	154	1,100	2,500	2,750,000

Source: completions - see Table A2-18

(10) LEASE AND WELL OPERATING EXPENSE

Lease and well operating expense or per barrel lifting costs were calculated on the basis of data contained in the 1953 and 1954

Since data relating well bores completed, and, consequently, a percentage of unsuccessful attempts are not given, we have had recourse to use statistics of exploratory and development drilling for the year 1964 for determination of statistics of successful completions in preparing the exploratory drilling statistics given in Table 4A-6A.

(3) DRILLING DEVELOPMENT COSTS

Data on the drilling potentials indicate water and gas is virtually non-existent. The cost of drilling, roughly proportional to the rate of development and the number per successful well completed has been included. This figure is an estimate dropping from year 1, assuming improvements resulting in the light of experience in drilling.

The calculations are shown in Table 4A-6B.

TABLE 4A-6B

CALCULATION

Cost Development Drilling Completions

Year	Cos	Completions Gas	Total Development	Average Cost Per Well	Average Cost
1967	107	96	143	$ 5,000	$ 715,000
1968	117	75	191	5,000	1,105,000
1969	140	50	270	4,000	2,360,000
1970	163	40	204	5,000	3,175,000
1971	193	115	374	5,000	3,885,000
1972	248	181	1,190	5,000	7,780,000

Assumed completions = 200 + 1.0(Year-1967)

(4) GAS AND WELL DEVELOPMENT EXPENSE

Gases and well operating expenses or pipe barrel during year-end inventory on the basis of gas connected in the 1967 - and 1972

P.B.S. Reports. We are concerned here only with direct lifting costs, and indications are that a portion of indirect costs were included in earlier years' expenditure estimates. We have added property taxes and surface lease rentals to the item "Operation of Wells" in the preparation of our estimates. These two items are direct costs which can be allocated as lifting costs.

Our estimated lifting cost is based on the average per barrel as shown in table A2-21. While certain inaccuracies, no doubt, result from using this average for the six year period which was one of rising wages, it is probably that increases in productivity due to larger batteries with more efficient utilization of labour and partial automation of field operations during the period kept labour costs relatively constant.

TABLE A2-21

CALCULATION OF AVERAGE LIFTING COST PER BARREL - ALBERTA
1953 and 1954

	1953	1954	Average
Labour - $M	7,355	7,719	7,537
Fuel - $M	346	372	359
Electricity $M	770	782	776
Materials & Supplies $M	6,017	3,716	4,867
Other - $M	6,090	8,600	7,345
Total Operation of Wells $M	20,578	21,189	20,884
Property Taxes $M	2,103	3,938	3,020
Surface Lease Rentals $M	3,161	3,469	3,315
	25,842	28,596	27,219
Oil Produced - M bbls	76,816	87,714	82,265
Lifting Cost, $ per bbl	.336	.326	.331

Use of this average cost of 33.1 cents per barrel gives the following figures for lifting costs.

Table A2-22

Lease and Well Operating Expense - Alberta 1947-1952

Year	M. Barrels Produced	Operating Expense $'000
1947	6,382	2,112
1948	10,505	3,477
1949	19,769	6,544
1950	27,148	8,986
1951	45,915	15,198
1952	58,916	19,501

(11) GAS PLANT OPERATING EXPENSE

Cash operating expense is a relatively insignificant item. In general, it varies with the throughput of plants. While no accurate cost figures for Alberta plants have been published, a cash operating cost of 3¢ per mcf processed seems reasonable in the light of the charge of 5¢ per mcf for stripped gas made by some of the plants. On this basis, operating costs for gas conservation plants can be estimated as follows:

Table A2-23

Calculation of Operating Costs - Gas Conservation Plants

Alberta - 1947-52

Year	Throughput M Mcf (1)	Processing cost @ $.03 per mcf. ($'000)
1947	27,957	838
1948	28,114	843
1949	28,240	847
1950	32,042	961
1951	38,262	1,148
1952	41,254	1,238

(1) Alberta Petroleum Industry, Annual Volumes 1947 - 1952

(12) ADMINISTRATION AND OVERHEAD

Administrative costs as defined in the P.B.S. Report

(2) For 1953 and 1954 include the following items:

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(2) Employment statistics and expenditures of firms engaged in the Development of Alberta's Oil Resources 1953 (Edmonton 1955) ibid 1954 (Edmonton 1956)

(11) GAS PLANT OPERATING COSTS

Cash operating expense is a relatively insignificant item. In general, it varies with the throughput of plants. Without accurate cost figures for Alberta plants have been published, a cash operating cost of 3¢ per mcf processed seems reasonable in the light of the charge of 6¢ per mcf for extracted gas made by many of the plants. On this basis, operating costs for gas conservation plants can be estimated as follows:

Table 10-02

Calculation of Operating Costs - Gas Conservation Plants
Alberta - 1947-52

Year	Throughput (1 mcf) (1)	Expenditure cost @ $ 0.03 per mcf (000)
1947	27,957	838
1948	30,414	912
1949	26,900	807
1950	26,063	781
1951	38,305	1,149
1952	41,294	1,239

(1) Alberta Petroleum Industry, Annual Volumes 1947 - 1952

(12) ADMINISTRATIVE AND OVERHEAD

Administrative costs as defined in the N.E.B. Report

(2) For 1954 and 1964 include the following items:

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(2) Employment statistics and expenditures of firms engaged in the Development of Alberta's Oil Industry, 1952 (Robinson 1955) and 1964 (Robinson 1966)

General Costs

Federal Provincial and Municipal Taxes Excluding Income Taxes

Capital Expenditures, Building, Equipment, Machinery, Land etc.

Leases, Rentals, Royalties and Fees, Surface Leases.

The increase in reported totals from about $45 Million in 1952 (1) to over $134 Million in 1953 strongly suggests that figures for earlier years were not reported on a comparable basis. It appears that all items listed except "General Costs" and Taxes would be more properly fitted in elsewhere. We have assumed that these two items make up the administrative and overhead costs referred to here. Table A2-24 shows these expenditures for 1953- and 1954 as related to total expenditures by "Oil Firms Proper" according to the Provincial Bureau's Report (I). Assuming as we have generally, that direct costs vary directly with activity, and assuming that supervision also varies with activity, it was felt that overhead could be best calculated as a percentage of direct expenditures for exploration, development and producing. 1953 and 1954 costs run about 8 percent of total expenditures according to the P.B.S. figures. These figures include Royalties, which ours do not, so a figure of 10 per cent of direct costs (equivalent to approximately 9 per cent of total, excluding Royalties and Financial payments) was used.

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(1) ibid. 1952 (Edmonton 1954.)

Table A2-24

Comparison of Administration and Overhead Costs with Total Expenditures - 1953 and 1954

	Thousands of Dollars	
	1953	1954
General Costs	23,051	24,436
Taxes, excluding Income Tax	2,057	2,449
Total Administration & Overhead	25,108	26,885
Total Expenditures	329,938	331,943
Percentage Administration & Overhead of total	7.63	8.11

Source PBS op. cit 1953 and 1954

(13) ROYALTIES

Royalty payments to mineral owners were calculated on the basis of payments received by the Crown which appear in the Public Accounts. Estimates appear in Table A2-25.

Table A2-25

Calculation of Royalty Payments by Alberta Producers

Year	Percentage of Production from Crown Lands.	Crown Royalty Receipts $M	Estimated Total Royalties paid. $M
1947	46.0	765	1,663
1948	45.5	1,619	3,558
1949	54.3	3,369	6,204
1950	64.7	4,761	7,358
1951	70.9	10,063	14,193
1952	68.2	12,353	18,113

Source Percentage of Production calculated from figures appearing in "Alberta Oil and Gas Industry" various Annual issues. Royalties from Public Accounts.

Table [illegible]

Comparison of Administration and Operating Costs with Total Expenditure - [illegible]

[illegible]	Thousands of Dollars	
	1963	1961
General Costs	[illegible]	[illegible]
Taxes, excluding Income Tax	[illegible]	[illegible]
Total Administrative Overhead	24,108	[illegible]
Total Expenditure	[illegible]	[illegible]
Percentage Administration & Overhead of Total	7.23	[illegible]
Source: [illegible] op. cit. [illegible] and 1962		[illegible]

(b) ROYALTIES

Royalty payments to mineral owners were calculated on the basis of percentages and of average crops which appear in the Prairie Economy, Crop Yields and Farm Income (op. cit.).

Table [illegible]

Calculation of Average Royalties in Alberta Producing Areas

Year	Percentage of Production Taken from Crown Lands	Crown Royalty Receipts	Estimated Total Production Yield
	%	$	$
1947	[illegible]	[illegible]	1,[illegible]
1948	[illegible]	1,[illegible]	[illegible]
1949	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]
1951	[illegible]	10,[illegible]	[illegible]
1952	[illegible]	10,[illegible]	[illegible]

Source: Percentage of Production calculated from Income appearing in "Alberta Oil and Gas Industry" various Annual issues. Royalties from Public Accounts.

14 FINANCIAL PAYMENTS.

(a) Payments for the Use of Capital

This category includes, as the name implies, dividend payments, interest payments, and distributions made to the owners of a type peculiar to the Western Canadian Petroleum Industry and known as royalty trusts. This form of organization apparently developed in Alberta during the earlier Turner Valley boom between 1937 and 1940 , and warrants a certain amount of description because of its uniqueness. Wells were drilled by trustees who sold certificates representing proportionate equitable ownership in the particular well. The trustee expended these funds and paid the net income to the certificate holders as "net royalties". This form of enterprise appears to be extinct for new organizations, but distributions are still being made to holders of such interests in Turner Valley wells, and were substantial in amount during the earlier part of the period under review.

Amounts shown in Table A2-27 were estimated on the basis of data appearing in the Financial Post's "Survey of Oils" for the various years. Coverage of companies by this publication is incomplete, as it omits private companies and the Canadian divisions or subsidiaries of American companies, for the most part. This omission is not too serious for our purpose as it is extremely doubtful if any of the companies or the producing departments of major integrated Canadian oil companies were in a profit position or sufficient of a cash surplus position to allow the payment of dividends during the period we are concerned with. An allowance has been made for a portion of the debt charges of one Canadian

major company where the borrowing is believed to be reasonably attributable to its expanded producing operations.

Table A2-26

Payments for use of Capital by Alberta Petroleum Producers, 1947 - 1952

Year	Dividends	Interest	Royalty Trust Distributions	Total
1947	1,337	114	820	2,271
1948	2,058	231	820	3,109
1949	2,668	437	575	3,680
1950	3,104	1,948	515	5,567
1951	2,927	2,810	465	6,202
1952	4,000	2,704	420	7,124

Source - Estimated from data appearing in the Financial Post's Survey of Oils Toronto, annual volumes 1947-1954.

b. Income Taxes

This is the second class of "financial" payments considered in this study. Besides Income Tax in the strictest sense it includes Old Age Security Tax and Excess Profits taxes, both calculated on income. Taxes are a small portion of the total expenditures during these years since few companies were in a position to be paying taxes, with the exception of some integrated companies which were already paying taxes on other income. The estimates used here were calculated from statistics appearing in the Department of National Revenue's Annual Publication "Taxation Statistics" (I).

(I) Ottawa, Queen's Printer, 1940-1954

major company where the borrowing is believed to be reasonably attributable to the expanded producing operations.

TABLE A3932

Payments for use of Capital by Jubilee Petroleum
Fiscal years, 1947 - 1952

Year	Dividends	Interest	Royalty Trust Distributions	Total
1947	1,357	124	890	2,371
1948	2,265	321	523	3,109
1949	2,282	427	371	3,080
1950	3,103	1,049	345	4,497
1951	3,327	2,400	475	6,202
1952	4,900	2,184	421	7,504

Source - Estimated from data appearing in the Financial Year's Survey of Oil: Toronto, annual volumes 1947-1954.

b. Income Taxes

This is the second class of financial payments considered in the study. Income Taxes, Tax in the strictest sense, includes Old Age Security Tax and Excess Profits taxes, both relatively unimportant. These are a small portion of the total expenditures during first years since few companies were in a position to be paying taxes, with the exception of some integrated companies which were already paying taxes on other income. The estimates used here were calculated from statistics appearing in the Department of National Revenue's Annual Publication "Taxation Statistics" (1).

(1) Ottawa, Queen's Printer, 1947-1954

Taxes paid by Oil, Gas or Naptha producers were taken directly from this report, while taxes applicable to producing operations or integrated companies were calculated by taking the depletion allowance claimed by Petroleum Refiners, multiplying by three to give depletable income, deducting depletion to give taxable income, then calculating income tax at the prevailing rates (2). A deduction was made for that portion of taxes assumed to be payable by concerns on profits earned outside Alberta. The amount, however, is small. No allowance was made for any excess profits tax payable on the producing income of integrated companies for 1947-1948. It is unlikely that the amount was significant.

Details of the calculation are shown in Table A2-27

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(2) Lower tax rates applicable to that portion of income under $20,000 were ignored as most companies were in a substantially better position if they earned a profit at all.

Table A2-27

Calculation of Income Taxes Paid
by
Alberta Oil Producers: 1947-52

(thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Depletion claimed by refiners	461	276	191	438	1,138	2,042
Depletable Income	1,383	828	573	1,314	3,414	6,126
Taxable Income	922	552	382	876	2,276	4,084
Income Tax Rate%	30	30	33	35(1)	45.6	50
Old Age Security deduction %						2
Total Tax %	30(2)	30(2)	33	35(1)	45.6	52
Tax paid. by Integrated Companies on Producing Operations	276	165	126	307	1,038	2,124
Oil Gas & Naptha Companies(3) Income Tax	1,175	1,665	1,138	1,430	1,364	2,016
Old Age Security						77
Excess Profits	148	20				
Total Corporate Income Taxes paid	1,599	1,850	1,264	1,737	2,402	4,217
Companies or Operations outside Alberta, (estimated)	250	250	200	300	350	500
Total Taxes paid by Alberta Producers	1,349	1,600	1,064	1,437	2,052	3,717

(1) Approximate. Changed from 33% to 38% September 1st.

(2) Except Excess Profits Tax.

(3) Including Royalty Syndicates.

Source Department of National Revenue, Taxation Statistics, Annual Volumes, 1949-54 inclusive

Appendix to Chapter 3

Allocation of Sector I Expenditures

1. LAND ACQUISITION AND RETENTION COSTS

This item is easily divided between Sectors by inspection of its component parts. Payments made for Crown rights fall into Sector III; payments for C.P.R. and C.N.R. acreage in Sector IV and H.B.C. receipts in Sector V. While not too much is known about the location of freehold mineral rights owners, it has been assumed that one-half reside in Alberta, one quarter elsewhere in Canada and one-quarter abroad. Table A3-1 shows the allocation of land expenditures.

Table A3-1

Allocation of Acreage Costs - Alberta, 1947-52
(Thousands of Dollars)

		Expenditures	Receipts			
		Sector I	Sector II	Sector III	Sector IV	Sector V
1947	Crown	800	-	800	-	
	CPR	600	-	-	600	-
	CNR	50	-	-	50	-
	HBC	30	-	-	-	30
	Other	200	-	100	50	50
	Total 1947	1,680	-	900	700	80
1948	Crown	10,921	-	10,921	-	-
	CPR	700	-	-	700	-
	CNR	100	-	-	100	-
	HBC	50	-	-	-	50
	Other	500	-	250	125	125
	Total 1948	12,271	-	11,171	925	175
1949	Crown	28,941	-	28,941	-	-
	CPR	800	-	-	800	-
	CNR	150	-	-	150	-
	HBC	80	-	-	-	80
	Other	800	-	400	200	200
	Total 1949	30,771	-	29,341	1,150	280
1950	Crown	37,156	-	37,156	-	-
	CPR	900	-	-	900	-
	CNR	200	-	-	200	-
	HBC	100	-	-	-	100
	Other	800	-	400	200	200
	Total 1950	39,156	-	37,556	1,300	300

Appendix to Chapter 3

Allocation of Section 1 Expenditures

1. LAND ACQUISITION AND RESTITUTION COSTS

This item is paid, without perhaps bodies by inspection of its component parts. Expenditures for Crown rights fall into Section III expenditures, C.I.R. and C.N.R. acreage in Sector IV and B.C. acreage in Sector V. While not too much information about the location of freehold mineral rights exists, it has been assumed that one-half occurs in Alberta, one quarter elsewhere in Canada and one-quarter abroad. Table A2-1 shows the allocation of land expenditures.

Table A2-1

Allocation of Average Costs - Alberta, 1947-52
(Thousands of Dollars)

	Treaty Rights			
	Sector I	Sector IV	Sector V	Sector V
1947 Crown	[illegible]	-	600	-
CIR	400	-	800	-
CNR	100	-	50	-
HBC	50	-	-	50
Other	200	-	100	50
Total 1947	1,250	-	500	100
1948 Crown	10,[illegible]	-	[illegible]	-
CPR	700	-	700	-
CIR	100	-	100	-
HBC	50	-	-	50
Other	500	-	100	150
Total 1948	12,[illegible]	-	[illegible]	[illegible]
1949 Crown	50,000	-	[illegible]	-
CPR	800	-	800	[illegible]
CIR	150	-	150	-
HBC	50	-	-	50
Other	500	-	500	250
Total 1949	50,[illegible]	-	[illegible]	[illegible]
1950 Crown	37,150	-	37,150	-
CPR	800	-	800	-
CIR	200	-	200	-
HBC	100	-	-	100
Other	800	-	400	200
Total 1950	39,150	-	[illegible]	300

Table A3-1
continued -

		Sector I	Sector II	Sector III	Sector IV	Sector V
1951	Crown	26,735	-	26,735	-	-
	CPR	956	-	-	956	-
	CNR	250	-	-	250	-
	HBC	120	-	-	-	120
	Other	900	-	450	225	225
Total 1951		28,961	-	27,185	1,431	345
1952	Crown	38,010	-	38,010	-	-
	CPR	1,555	-	-	1,555	-
	CNR	300	-	-	300	-
	HBC	150	-	-	-	150
	Other	1,000	-	500	250	250
Total 1952		41,015	-	38,510	2,105	400

2. GEOLOGICAL and GEOPHYSICAL SURVEY COSTS

Since we have assumed that all geophysical surveys were conducted by contractors, this portion of expenditures has been allocated entirely to Sector II. The same applies to expenditures for structure test drilling.

Much of the cost of operating geological surface parties, and of administration and supervision consists of salaries, wages, and materials and supplies purchased locally. Ninety percent of the cost of these items, therefore, has been allocated to Sector III, while the balance has been split evenly between Sectors IV and V. Table A3-2 shows the breakdown of survey costs.

Table A3-2

Allocation of Survey Costs - Alberta, 1947-52
(Thousands of Dollars)

		Expenditures				
		Sector I	Sector II	Sector III	Sector IV	Sector V
1947	Geophysical	2,772	2,772	-	-	-
	Surface Geology	215	-	193	11	11
	Structure Test	72	72	-	-	-
	Supervision	306	-	275	15	16
	Total 1947	3,365	2,844	458	26	27

Table A-1
Continued -

	Sector I	Sector II	Sector III	Sector IV	Sector V
1951 Crews	44,738	-	34,791	-	-
OPC	[illegible]	-	-	800	-
OPR	300	-	-	250	-
JOC	100	-	-	-	100
Other	600	-	800	100	500
Total 1951	46,801	-	[illegible]	[illegible]	[illegible]
1952 Crews	54,[illegible]	-	44,000	-	-
OPC	1,320	-	-	1,555	-
OPR	300	-	-	300	-
JOC	100	-	-	-	100
Other	1,000	-	100	200	500
Total 1952	[illegible]	-	[illegible]	2,155	100

2. OPERATIONS and OPERATIONAL SUPPORT COSTS

Since we have assumed that all geophysical surveys were conducted by contractors, the portion of expenditures has been allocated entirely to Sector II. The same applies to expenditures for airborne test drilling.

Most of the cost of operating geophysical parties, drilling, and of administration and supervision consists of salaries, wages, and materials and supplies purchased locally. Nearly percent of the cost of these items, therefore, has been allocated to Sector III, while the balance has been equally between Sectors IV and V. Table A-2 shows the breakdown of survey costs.

Table A-2

Allocation of Survey Costs - Years, 1947-51
(Thousands of Dollars)

	Expenditures				
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947 Geophysical	3,778	3,793	-	-	-
Surface Drilling	216	-	108	11	11
Structure Test	72	72	-	-	-
Supervision	300	-	300	15	15
Total 1947	3,366	3,865	[illegible]	[illegible]	[illegible]

Table A3-2
continued

		Expenditures				
		Sector I	Sector II	Sector III	Sector IV	Sector V
1948	Geophysical	7,830	7,830	-	-	-
	Surface Geology	270	-	242	14	14
	Structure Test	492	492	-	-	-
	Supervision	858	-	772	43	43
	Total 1948	9,450	8,322	1,014	57	57
1949	Geophysical	17,775	17,775	-	-	-
	Surface Geology	350	-	314	18	18
	Structure Test	972	972	-	-	-
	Supervision	1,908	-	1,718	95	95
	Total 1949	21,005	18,747	2,032	113	113
1950	Geophysical	22,480	22,480	-	-	-
	Surface Geology	400	-	360	20	20
	Structure Test	2,532	2,532	-	-	-
	Supervision	2,543	-	2,289	127	127
	Total 1950	27,955	25,012	2,649	147	147
1951	Geophysical	32,375	32,375	-	-	-
	Surface Geology	500	-	450	25	25
	Structure Test	4,524	4,524	-	-	-
	Supervision	3,741	-	3,367	187	187
	Total 1951	41,140	36,899	3,817	212	212
1952	Geophysical	37,060	37,060	-	-	-
	Surface Geology	600	-	540	30	30
	Structure Test	4,560	4,560	-	-	-
	Supervision	4,220	-	3,798	211	211
	Total 1952	46,440	41,620	4,338	241	241

3. EXPLORATORY DRILLING COSTS

Our breakdown of drilling costs is based on the same Provincial Bureau statistics used for estimating these costs (1) and on D.B.S. reports covering contractors' revenues and expenditures for the years 1945-52 (2).

On the basis of these studies, drilling costs were broken down as follows:

---

(1) Employment Statistics and Expenditures, etc. 1951-54.

(2) D.B.S., Contract Drilling in the Mining Industry 1946-52.

Table 14-3
continued

	Expenditures				
	Sector I	Sector II	Sector III	Sector IV	Sector V
1948 Conjectural	[illegible]	[illegible]	-	-	-
Surface Geology	270	-	342	14	74
Structure Test	183	192	-	-	-
Subsurface	588	-	272	45	46
Total 1948	[illegible]	[illegible]	[illegible]	97	97
1949 Conjectural	[illegible]	[illegible]	-	-	-
Surface Geology	360	-	374	18	38
Structure Test	912	872	-	-	-
Subsurface	1,088	-	[illegible]	85	84
Total 1949	[illegible]	[illegible]	[illegible]	118	118
1950 Conjectural	[illegible]	[illegible]	-	-	-
Surface Geology	400	-	300	20	30
Structure Test	[illegible]	[illegible]	-	-	-
Subsurface	[illegible]	-	[illegible]	127	127
Total 1950	[illegible]	[illegible]	[illegible]	127	127
1951 Conjectural	[illegible]	[illegible]	-	-	-
Surface Geology	300	-	320	25	30
Structure Test	[illegible]	[illegible]	-	-	-
Subsurface	[illegible]	-	[illegible]	187	187
Total 1951	[illegible]	[illegible]	[illegible]	212	212
1952 Conjectural	[illegible]	[illegible]	-	-	-
Surface Geology	300	-	340	32	30
Structure Test	[illegible]	[illegible]	-	-	-
Subsurface	[illegible]	-	[illegible]	241	241
Total 1952	[illegible]	[illegible]	[illegible]	241	241

7. EXPLORATORY DRILLING COSTS

Our predictions of drilling costs is based on the same Provincial Lease statistics used for estimating these costs (1) and on D.E.S. reports covering contractor's revenues and expenditures for the years 1948-52 (2).

In the tests in that study, drilling costs were broken down as follows:

---

(1) Employment Statistics and Expenditures, etc. 1951-52.

(2) D.E.S., Contract Drilling in the Mining Industry 1948-52.

	$ per foot	%
Payment to Contractor	7.10	48.8
Labour	1.05	7.2
Fuel	.12	0.8
Materials and Supplies	2.42	16.1
Services (3)	3.84	27.1
Total	14.53	100.0

Table A3-3 shows a breakdown of the exploratory drilling costs listed in Table A2-17 into the above components.

Table A3-3

Exploratory Drilling Cost Components - Alberta, 1947-52
(Thousands of Dollars)

Year	Contract Payment (48.8%)	Labour (7.2%)	Fuel (0.8%)	Materials & Supplies (16.1%)	Services (27.1%)	Total
1947	2,382	351	39	786	1,322	4,880
1948	4,340	639	71	1,431	2,409	8,890
1949	7,666	1,131	126	2,532	4,255	15,710
1950	7,806	1,167	130	2,609	4,388	16,200
1951	12,010	1,770	197	3,960	6,663	24,600
1952	16,800	2,477	275	5,540	9,308	34,400

Allocation of these cost components between Sectors is a relatively simple matter. Contract payments (to drillers) and Services are both provided by Sector II firms and will be more thoroughly broken down at a later point. It is safe to assume that labour and fuel payments were made to residents of Alberta or Alberta firms, so these two classes of payments fall into Sector III. Virtually all materials and supplies used in drilling wells are supplied by various service companies, leaving only casing, tubing and some bits to be supplied by the operator. If we assume, as seems reasonable, that the "materials and supplies" item includes casing, tubing and bits, which were not manufactured in Canada during this period, we may allocate this item to Sector V. Table A3-4 summarizes the results of the allocation just described.

(3) Including wellsite grading, mud, cementing, acidizing, testing, perforating, fishing, logging, core barrel rental and consultants' fees.

[illegible]	[illegible]	[illegible]
Payment in Contraband	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Materials and Supplies	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]

Table A5-2 shows a breakdown of the monetary savings [illegible] Table 1.

Table A5-17 lists the score [illegible].

Table A5-17

Exploratory Studies [illegible] - [illegible], 1977-81

Year	Contract Payment	Labor	Total	Material Costs	Overhead	Total
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Table A3-4

Allocation of Exploratory Drilling Costs - Alberta, 1947-52.
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	4,880	3,704	390	-	786
1948	8,890	6,749	710	-	1,431
1949	15,710	11,921	1,257	-	2,532
1950	16,200	12,294	1,297	-	2,609
1951	24,600	18,673	1,967	-	3,960
1952	34,400	26,108	2,752	-	5,540

4. DEVELOPMENT DRILLING COSTS

Development drilling costs were broken down in the same manner as Exploratory drilling costs. The breakdown into components is shown in Table A3-5, while the allocation to Sector accounts appears in Table A3-6

Table A3-5

Development Drilling Cost Components - Alberta, 1947-52
(Thousands of Dollars)

Year	Contract Payments (48.8%)	Labour (7.2%)	Fuel (0.8%)	Materials & Supplies (16.1%)	Services (27.1%)	Total
1947	3,875	572	64	1,278	2,151	7,940
1948	6,900	1,018	113	2,277	3,832	14,140
1949	15,128	2,232	248	4,991	8,401	31,000
1950	22,790	3,362	374	7,519	12,655	46,700
1951	27,426	4,046	450	9,048	15,230	56,200
1952	30,280	4,468	496	9,990	16,816	62,050

Table A3-6

Allocation of Development Drilling Costs - Alberta, 1947-52

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	7,940	6,026	636	-	1,278
1948	14,140	10,732	1,131	-	2,277
1949	31,000	23,529	2,480	-	4,991
1950	46,700	35,445	3,736	-	7,519
1951	56,200	42,656	4,496	-	9,048
1952	62,050	47,096	4,964	-	9,990

Table A3-4

Allocation of Development Drilling Costs - Alberta, 1947-82

(Thousands of Dollars)

Year	Expenditures Sector I	Receipts Sector II	Sector III	Sector IV	Sector V
1947	7,940	5,026	838	-	1,278
1948	14,140	10,722	1,121	-	2,297
1949	21,020	20,232	2,460	-	4,088
1950	41,760	30,444	3,738	-	7,318
1951	70,320	43,840	5,406	-	8,048
1952	83,040	47,000	4,284	-	8,980

5. PUMPING and LEASE EQUIPMENT COSTS

Of these costs, by far the greater part represent equipment costs, the rest being installation costs and freight. During this period, virtually all the equipment for oil-lease installations was imported. Equipment costs, therefore, have been treated as payments to Sector V. Installation costs comprise, mainly, wages paid to Albertans and profits accruing to small businesses situated here. Freight charges have been split between Canadian and foreign carriers on a 50-50 basis. The percentages used for allocation are as follows:

Equipment (Sector V)	82.5%	
Installation (Sector III)	8.7%	
Freight	8.8%	(Sector IV - 4.4%)
		(Sector V - 4.4%)

These percentages are based on an analysis of the cost estimates used. Allocation of these expenditures is shown in Table A3-7.

Table A3-7

Allocation of Battery Costs - Alberta, 1947-52
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	1,352	-	118	59	1,175
1948	3,040	-	264	134	2,642
1949	7,602	-	662	334	6,606
1950	11,347	-	987	499	9,861
1951	12,521	-	1,089	551	10,881
1952	15,745	-	1,370	693	13,682

6. COST of GAS PLANTS, GATHERING SYSTEMS and RELATED EQUIPMENT

Cost of these facilities has been allocated to Sector II, as they are generally built by specialized contractors. Further allocation from Sector II to Sectors III, IV and V will be made in a later chapter.

7. OTHER DEVELOPMENT COSTS

These include the cost of such "offsite facilities" as field offices, warehouses, firefighting installations, hospitals, etc. For the present, these are also shown as a payment to Sector II to be broken down at a later point.

8. LEASE and WELL OPERATING EXPENSES

The following percentage breakdowns of well operating expense are based on available published figures from different sources:

	Source of Estimate	
	Paine (4)	P.B.S. (5)
Supervision	5%	28%
Labour	60%	
Fuel and Power	12%	4%
Materials, Supplies, Repairs, etc.	23%	45%
Taxes (Municipal)	-	11%
Surface Rentals	-	12%
	100%	100%

These two sets of figures, prepared some twelve years apart, reveal, through the increasing expenditureson "materials, supplies, repairs, etc." and decreasing expenditures on labour, the increased mechanization that has taken place in the oil field over the past decade and is still going on. The items for taxes and surface rentals are, of course, due to legal differences between Canadian and American operations. In the U.S., taxes in support of local or state governments often take the form of severance or sales taxes, while in Alberta, most municipalities levy a personal property tax. Again, in the U.S., mineral rights are held by the landowner so that a mineral lease usually contains right-of-entry provisions, while in Alberta the Crown usually owns the minerals and a separate lease from the surface owner is necessary

(4) Paine, Paul - Oil Property Valuation, N.Y. 1942, Percentages calculated from data on p.118.

(5) Provincial Bureau of Statistics estimates used in Table A2-21 (1953-54 figures)

7. OTHER DEVELOPMENT COSTS

[illegible] DEVELOPMENT COSTS

These include the cost of such "[illegible] facilities" as field offices, warehouses, fire-fighting installations, hospitals, etc. For the present, these are also shown as a payment in Section II to be broken down at a later point.

8. LEASE AND WELL OPERATIVE EXPENSES

The following percentage breakdowns of well operating expenses are based on available published figures from different sources:

	Source of Estimate	
Expense	[illegible]	[illegible]
Supervision	[illegible]	28%
Labour	[illegible]	[illegible]
Fuel and Power	[illegible]	[illegible]
Materials, Supplies,	[illegible]	[illegible]
Repairs, etc.	[illegible]	45%
Taxes (Land-Lease)	—	11%
Surface Rentals	—	13%
[illegible]	[illegible]	100%

These two sets of figures, prepared some twelve years apart, reveal, [illegible] through the increasing expenditures on materials, supplies, repairs, etc., [illegible] and decreasing expenditures on labour, the increased mechanization that has taken place in the oil field over the past decade and is still going on. The [illegible] terms for taxes and surface rentals are, of course, due to legal differences between Canadian and American operations. In the U.S., taxes in support of local or state governments often take the form of severance or sales taxes, while in Alberta, most municipalities levy a personal property tax. Again, in the U.S., mineral rights are held by the landowner so that a mineral lease usually contains right-of-entry provisions, while in Alberta the Crown usually owns the minerals and a separate lease from the surface owner is necessary [illegible]

(4) Fabian, Paul - Oil Property Valuation, N.Y. 1953. Percentages calculated from data on p.112.

(5) Provincial Bureau of Statistics estimates used in Table A3-31 (1953-54 figures)

to gain entry.

As the period covered by our study is somewhat earlier than than covered by the P.B.S. figures, we may assume a lower degree of mechanization and higher relative labour costs. The following breakdown was used:

Labour	33%
Fuel and Power	4%
Materials, etc.	40%
Taxes (Municipal)	11%
Surface Rentals	12%
	100%

This yields a distribution between Sectors as shown in Table A3-8.

Table A3-8

Percentage Allocation of Well Operating Cost - 1947-52

	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
Labour	33	-	33	-	-
Fuel & Power	4	-	4	-	-
Materials, etc.	40	20	6	6	8
Taxes (Municipal)	11	-	11	-	-
Surface Rentals	12	-	10	1	1
Total	100	20	64	7	9

N.B. The portion of expenditures for materials, supplies, etc., going to Sector II included the cost of equipment rentals, workovers done by contractors, etc.

The resulting distribution of lifting costs is shown in Table A3-9.

Table A3-9

Allocation of Well Operating Costs - Alberta, 1947-52
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	2,112	422	1,352	148	190
1948	3,477	695	2,226	243	313
1949	6,544	1,309	4,188	458	589
1950	8,986	1,797	5,751	629	809
1951	15,198	3,040	9,726	1,064	1,368
1952	19,501	3,900	12,481	1,365	1,755

to grab away.

As the period covered by the data is so short, it is difficult to draw any conclusions from the V.I.S. figures, but they indicate a lower degree of concentration and higher relative labour costs. The following breakdown was used:

Factor	Weight
Labour	35%
Fuel and Power	11
Materials, etc.	40%
Taxes (Income)	1%
Depreciation	3%
	100%

The yields a distribution between Sectors as shown in Table 43-8.

Table 43-8

Percentage Allocation of V.I.S. in Operating Cost - 1947-52

Expenditure Factor	Revenue Sector I	Sector II	Sector III	Sector IV	Sector V
Labour	35	-	35	-	-
Fuel & Power	4	-	4	-	-
Materials, etc.	40	32	8	8	40
Taxes (Income)	1	-	1	-	-
Depr.	11	-	11	-	-
Gross Profits	12	-	12	1	1
Total	100	32	68	9	41

N.B. The profits of enterprises in materials, supplies, etc. appear in Sector II because the cost of operational rentals, warehouses, data processing machines, etc.

The resulting distribution of Indian costs is shown in Table 43-9.

Table 43-9

Allocation of V.I.S. Operating Costs - Atlantic, 1947-52
(Percentage of Indian)

Year	Expenditure Factor I	Revenue Sector II	Sector III	Sector IV	Sector V
1947	5.419	[illegible]	[illegible]	1.0	[illegible]
1948	7.417	[illegible]	6.320	.212	.013
1949	8.091	[illegible]	1.320	.138	[illegible]
1950	8.968	1.117	5.191	.034	.016
1951	10.200	2.080	7.78	1.064	[illegible]
1952	12.901	4.238	10.001	1.067	[illegible]

9. GAS PLANT OPERATING EXPENSE

Principal items of cash expense in gas plant operation include labour, materials and supplies, fuel and power. Allocation of these costs between Sectors indicates that 90% of the operating expense goes to Sector III, the balance to Sector IV (6).

The resulting allocation of expense is shown in Table A3-10.

Table A3-10

Allocation of Gas Plant Operating Expense - Alberta, 1947-52
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	838	-	754	84	-
1948	843	-	759	84	-
1949	847	-	762	85	-
1950	961	-	865	96	-
1951	1,148	-	1,033	115	-
1952	1,238	-	1,114	124	-

10. ADMINISTRATION and OVERHEAD COSTS

Allocation of administrative and overhead costs is shown in Table A3-11. Receipts by Sector II include rentals on office buildings, here assumed to be owned by "service companies". Receipts by Sector III include salaries, wages, fuel and power costs, materials and supplies and taxes, while Sectors IV and V receive a portion of head office administrative costs and research expenditures, Sector IV receiving in addition some tax payments.

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(6) Blaw Knox Company submission before Conservation Board, January, 1953, re Leduc Southern Gas Absorption Ltd. - Exhibit 23, Table 3.

9. GAS PLANT OPERATING EXPENSES

Principal items of each element of gas plant operation include labour, materials and supplies, fuel and power. Allocation of these costs between Sectors indicates that 90% of the operating expense goes to Sector III, the balance to Sector IV (6).

The resulting allocation of expense is shown in Table A5-10.

Table A5-10

Allocation of The Fuel Gas(6) Company - Alberta, 1947-55
(Thousands of Dollars)

Year	Expenditures	Sectors			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	650	-	[illegible]	[illegible]	-
1948	646	-	728	84	-
1949	347	-	343	45	-
1950	931	-	805	96	-
1951	1,148	-	1,072	115	-
1952	1,239	-	1,114	124	-

10. ADMINISTRATION and OVERHEAD COSTS

Allocation of administrative and overhead costs is shown in Table A5-11.

Operating by Sector II includes rentals on office buildings, here assumed to be owned by "service companies". Borrowing by Sector III includes salaries, wages, fuel and power costs, materials and supplies and taxes, while Sectors IV and V receive a portion of head office administrative costs and research expenditures, Sector IV receiving in addition some tax payments.

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(6) Alberta Gas Company subsidiary which became Conservation Board, January, 1954, in Lower Southern Gas Processing Ltd. - Exhibit 29, Table 3.

Table A3-11

Allocation of Administrative and Overhead Costs - 1947-52.
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	2,288	600	985	140	563
1948	5,331	1,000	2,290	408	1,633
1949	11,778	2,400	5,100	855	3,423
1950	15,618	3,400	6,720	1,099	4,399
1951	18,423	4,600	7,910	1,182	4,731
1952	22,589	5,200	9,700	1,538	6,151

11. ROYALTIES

Royalty payments were allocated in a manner similar to lease rental payments. Published Crown royalty figures, plus one-half estimated "other freehold" royalty were credited to Sector III, C.P.R., C.N.R. and one-quarter "other freehold" to Sector IV, H.B.C. and one-quarter of "other freehold" to Sector V. The resulting allocation is shown in Table A3-12.

Table A3-12

Allocation of Royalty Payments - Alberta - 1947-52.
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	1,663	-	1,079	357	227
1948	3,558	-	2,338	760	460
1949	6,204	-	4,402	1,116	686
1950	7,358	-	5,550	1,194	614
1951	14,193	-	11,369	1,883	941
1952	18,113	-	14,008	2,873	1,232

12. INTEREST and DIVIDENDS

As mentioned in the Appendix to Chapter 2, interest and dividend payments were calculated from Financial Post data (7). From data in these reports plus certain D.B.S. material (8), it was possible to arrive at fairly

(7) Survey of Oils, Toronto, 1947-1954

(8) The Canadian Balance of International Payments 1926-1948, Ottawa, 1949. Canada's Balance of International Payments 1946-55, Ottawa, 1956. International Distribution of Ownership of the Petroleum Industry in Canada (Reference Paper No. 37), Ottawa, 1952.

[illegible]

[illegible]

(thousands of dollars)

Year	Expenditures Series I	Series II	Series III	Series IV	Series V
1947	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1948	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1949	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

11. [illegible]

Royalty payments were allocated in a manner similar to lease rental payments. Tabulated from royalty figures, plus one-half anticipated royalty probably would accrue to Series III, I, V, II, C.H.E. and one-quarter "other" allocation to Series IV, M.H.C. and one-quarter of "other" allocation to Series V. The resulting allocation is shown in Table A3-12.

Table A3-12

Allocation of Royalty Payments, Series I - IV, 1947-52
(thousands of dollars)

Year	Series I	Series II	Series III	Series IV
1947	[illegible]	-	[illegible]	[illegible]
1948	[illegible]	-	[illegible]	[illegible]
1949	[illegible]	-	[illegible]	[illegible]
1950	[illegible]	-	[illegible]	[illegible]
1951	[illegible]	-	[illegible]	[illegible]
1952	[illegible]	-	[illegible]	[illegible]

12. [illegible] and DIVIDENDS

As mentioned in the discussion of Charges 7, interest and dividend payments were calculated from actual [illegible] data (7). From data in these sources plus [illegible] in (8), it was possible to arrive at [illegible]

(7) Bureau of Office, [illegible] 1947-1954

(8) The Economic Report of the President [illegible] Washington, D.C., 1954, Chapter 2, Table [illegible] and Economic Report of the President [illegible] Washington, D.C., 1955, Chapter 2, Table [illegible]

Conference Paper No. 871, Ottawa, 1956

realistic estimates of where securities were held. For the distribution between Alberta and other parts of Canada, location of underwriters, stock exchange listings and population distribution were taken into account. Allocation of interest and dividend payments was made on the following basis.

(a) Interest: Interest on foreign held debt was calculated at known rates. The balance was allocated between Alberta and the rest of Canada in a 1:9 ratio.

(b) Royalty Trust Distributions were allocated between Alberta, the rest of Canada and foreign countries on an 8:1:1 ratio.

(c) Dividend Payments of foreign countries were estimated on the basis of estimated foreign ownership, while domestic payments were split between Alberta and the rest of Canada in the ratio of 1:9.

The resulting allocation of payments between Sectors is shown in Table A3-13.

Table A3-13

Allocation of Interest and Dividend Payments - 1947-52.
(Thousands of Dollars)

Year	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	2,271	-	789	1,267	215
1948	3,109	-	862	1,919	328
1949	3,680	-	738	2,563	379
1950	5,567	-	845	3,962	760
1951	6,202	-	831	4,185	1,186
1952	7,124	-	836	4,540	1,748

13. INCOME TAXES

Two alternative approaches are possible to the problem of allocating income taxes between Sectors III and IV.

The first of these bases the allocation on the ratio between Federal government receipts and expenditures in Alberta, which, for the years

1947-52, is practically unity. With this assumption, the entire tax revenue could be regarded as revenue for Sector III, as payments to Albertans equal revenue received. This tends to overlook two things:

(1) Oil companies operating in Alberta may have offices in Ontario and pay taxes through Ontario offices of the Department of National Revenue. This tends to question the validity of statistics on the ratio of Federal government spending and revenue in Alberta.

(2) More serious is the objection that had Alberta not developed an oil-producing industry after World War II, she would have been a "have-not" province, or one in which Federal spending exceeds receipts. It is, thus, possible to argue that much of the Federal spending in Alberta in this period would have taken place regardless of whether there was an oil industry or not. Existence of the industry enabled Alberta to pay its own way, but did not determine the level of spending in any great degree.

It is obvious that inclusion of Federal payments to Albertans on the above basis would tend to overestimate the effect of development in this industry on the Alberta economy to the extent that Federal expenditures would have been made anyway. Because of these objections, this approach has been rejected.

The alternative chosen rests on the following reasoning:

(1) Tax receipts by the Federal government were increased by the development of this industry.

(2) As a result, tax rental payments to the provinces were also increased, and Alberta shared in this increase.

Accordingly, income taxes have been allocated between the Federal government (Sector IV) and the provincial government (Sector III), based

1947-52, is practically nil. With this assumption, the entire tax revenue could be regarded as revenue for Sector III, as payments to Alberta equal revenue received. This leads to developing two hypotheses:

(1) Oil companies operating in Alberta may have offices in Ontario and pay taxes through Ontario offices of the Department of National Revenue. This leads to question the validity of statistics on the ratio of Federal government spending and revenue in Alberta.

(2) Here serious is the objection that had Alberta not developed its oil producing industry after World War II, she would have been a have-not province, or one in which Federal spending exceeds revenue. It is, thus, possible to argue that much of the Federal spending in Alberta in this period would have taken place regardless of whether there was an oil industry or not. Exclusion of the industry enables Alberta to pay its own way, but did not determine the level of spending in any great degree. It is obvious that inclusion of Federal payments to Alberta on the above basis would tend to overestimate the effect of developments in this industry on the Alberta economy to the extent that Federal expenditures would have been made anyway. Because of these objections, this approach was not selected.

The alternative chosen rests on the following reasoning:

(1) Tax receipts by the Federal government were increased by the development of this industry;

(2) As a result, the rental payments to the provinces were also increased, and Alberta shared in this increase.

Accordingly, income taxes have been allocated between the Federal government (Sector IV) and the provincial government (Sector VI), based

on the ratio that tax rental payments to Alberta bear to tax rental payments as a whole, applied to the proportion of Federal tax revenue paid out under tax rental agreements. These figures are shown in Table A3-14.

Table A3-14

Federal Tax Revenue and Tax Rental Payments 1947-52
(Fiscal years, ending March 31, 1948-53)

	A. Tax Rental Paid to Alberta	B. Total Tax Rental Paid	C. Federal Succession Duty, Income and Corporation Tax Revenue	% A of C
1947	6	130	1,313	0.46
1948	13	84	1,368	0.95
1949	14	80	1,301	1.07
1950	12	93	1,557	0.77
1951	15	96	2,204	0.68
1952	32	303	2,594	1.19

It is believed that this method of allocation is as realistic as possible, bearing in mind the impossibility of determining from taxation statistics the source of the profits which are taxed. This basis of estimating may actually overstate the importance of this source of revenue to the provincial government, for, without oil, Alberta would be another have-not province and might have received Federal subsidies to ease the burdens of government.

However, it may also tend to underestimate the effect on Alberta as a whole, as more buoyant revenues may have had some tendency to increase spending in Alberta as well as in other parts of Canada.

Table A3-15 shows the results of an allocation made on the above basis.

Table A3-15
Allocation of Income Taxes 1947-52
(Thousands of Dollars)

	Expenditures	Receipts			
	Sector I	Sector II	Sector III	Sector IV	Sector V
1947	1,349	-	6	1,343	-
1948	1,600	-	15	1,585	-
1949	1,064	-	11	1,053	-
1950	1,437	-	11	1,426	-
1951	2,052	-	14	2,038	-
1952	3,717	-	44	3,673	-

[illegible] Table 43-11.

Table 43-11

Federal Tax Savings and Total Investment 1947-1[illegible]
(Figures rounded, in thousands of 1[illegible])

	A. Tax Savings by Adopting		B. Total Tax Savings Under Section 1[illegible]		C. Total Investment Under Section 1[illegible]	
	Number	Amount	Number	Amount	Number	Amount
1947	1	1[illegible]	1[illegible]	1,[illegible]	[illegible]	[illegible]
1948	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1949	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

It is believed that this method of allocation is as realistic as possible, having in mind the practicability of determining some logical relationship between the source of the profits and the tax benefit. This method of allocation may actually overstate the importance of the economic effect of Section 1[illegible] on investment, but without all the information in the hands of the Internal Revenue Service, it is not possible to make a more accurate determination.

However, it may also be that Section 1[illegible] has had an effect on choices of which, the more conservative approach may tend to make evident by showing a lessening in Income as well as in other forms of Income.

Table 43-12 shows the results of the allocation method on the above basis.

Table 43-12

Allocation of Income, 1947-19[illegible]
(Amounts in Thousands)

	Expenditures					
	Section 1[illegible]	Section 1[illegible]		Section 1[illegible]		Section 1[illegible]
		Number	Amount	Number	Amount	Number	Amount
1947	1,[illegible]	-	-	3	1,[illegible]	-
1948	1,[illegible]	-	-	10	1,[illegible]	-
1949	1,[illegible]	-	-	[illegible]	[illegible]	-
1950	1,[illegible]	-	-	14	[illegible]	-
1951	2,[illegible]	-	-	16	2,[illegible]	-
1952	2,[illegible]	-	-	16	2,[illegible]	-

A. Geophysical Contractors

(a) Income account

Income has been broken down on the basis of the following percentages:

Geophysical Cost per Crew Month[1]

	$	%
Labour	6,400	32.0
Materials and Supplies	7,100	35.5
Depreciation	2,500	12.5
Profit	4,000	20.0
	20,000	100.0

Using these percentages, operating costs have been estimated as follows. Income taxes have been calculated at the rates shown in Table A2-27.

Table A5-1

Estimated Geophysical Income and Expense, Alberta, 1947-52
(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Total Income	2,772	7,830	17,775	22,480	32,375	37,060
Labour	886	2,502	5,680	7,200	10,340	11,870
Materials and Supplies	984	2,785	6,305	7,980	11,480	13,160
Taxes	166	470	1,078	1,577	2,955	3,745
Profit after Tax	388	1,096	2,477	2,919	3,520	3,667
Total Cash	2,424	6,853	15,540	19,676	28,295	32,442
Depreciation	348	977	2,235	2,804	4,080	4,618
	2,772	7,830	17,775	22,480	32,375	37,060

(1) These percentages are estimates based on data given by Kastrop, J. E., World Oil (Vol. 132, No. 6) (May 1951) p. 55. The figures shown relate to seismic operations but have been used for all types as no information is available showing differences between types.

In allocating these expenditures to sector accounts, the following procedures were followed.

Labour costs were allocated to Sector III in their entirety. The major items of materials and supplies purchased in Alberta are gas, oil and repairs. Including other incidental local purchases, it is estimated that about 40% of materials and supplies expenditures was spent in Alberta. Other materials and supplies used include explosives, recording film, chemicals, rock bits, drill pipe and many minor items. Of the imports it is estimated that 40% were purchased in Canada, the balance imported from abroad. Materials and supplies then are split between Sector III - 40%, Sector IV - 24% and Sector V - 36%.

Allocation of profits was based on the number of crews operated by Canadian firms and foreign firms each year as shown in Table A5-2.

Table A5-2

Ownership of Geophysical Crews, Alberta, 1947-52 (1)

Year	Crews Operated	Ownership		Percent Canadian
		Canadian	Other	
1947	20	5	15	25
1948	60	10	55	17
1949	90	15	75	17
1950	100	20	80	20
1951	120	25	95	21
1952	133	30	103	29

The Canadian crews were operated by Alberta firms. Profits have been split between Sector III and Sector V on the basis of the percentages appearing in Table A5-2. Taxes were divided on the basis used in Table A3-15. The resulting allocation of Geophysical firms' income account is shown in Table A5-3.

(1) Based on data in Oil in Canada, Oct. 20, 1952, Nov. 17, 1952; C.P.A. Statistical Bulletin, Fall 1955; Canadian Oil & Gas Directory, 1953.

Table A5-3

Allocation of Geophysical Firms' Expense (Income Account)

Alberta, 1947-52

(Thousands of Dollars)

Year	Item	Total	Sector III	Sector IV	Sector V	Depreciation
1947	Labour	886	886	-	-	-
	Materials and Supplies	984	394	236	354	-
	Taxes	166	1	165	-	-
	Profit	388	97	-	291	-
	Depreciation	348	-	-	-	348
	Total	2,772	1,378	401	645	348
1948	Labour	2,502	2,502	-	-	-
	Materials and Supplies	2,785	1,115	668	1,002	-
	Taxes	470	5	465	-	-
	Profit	1,096	186	-	910	-
	Depreciation	977	-	-	-	977
	Total	7,830	3,808	1,133	1,912	977
1949	Labour	5,680	5,680	-	-	-
	Materials and Supplies	6,305	2,520	1,515	2,270	-
	Taxes	1,078	11	1,068	-	-
	Profit	2,477	420	-	2,057	-
	Depreciation	2,235	-	-	-	2,235
	Total	17,775	8,631	2,582	4,327	2,235
1950	Labour	7,200	7,200	-	-	-
	Materials and Supplies	7,980	3,190	1,920	2,870	-
	Taxes	1,577	12	1,565	-	-
	Profit	2,919	583	-	2,336	-
	Depreciation	2,804	-	-	-	2,804
	Total	22,480	10,985	3,485	5,206	2,804
1951	Labour	10,340	10,340	-	-	-
	Materials and Supplies	11,480	4,590	2,760	4,130	-
	Taxes	2,955	20	2,935	-	-
	Profit	3,520	710	-	2,810	-
	Depreciation	4,080	-	-	-	4,080
	Total	32,375	15,660	5,695	6,940	4,080
1952	Labour	11,870	11,870	-	-	-
	Materials and Supplies	13,160	5,260	3,170	4,730	-
	Taxes	3,745	45	3,700	-	-
	Profit	3,667	1,062	-	2,605	-
	Depreciation	4,618	-	-	-	4,618
	Total	37,060	18,237	6,870	7,335	4,618

(b) Capital Expenditures

In 1946 there were 15 geophysical parties in operation in Alberta. The estimated age structure of this population was as follows at January 1, 1947.

Under one year	2
One to two years	4
Two years and over	9
	15

In estimating the capital expenditures made on geophysical equipment, it has been assumed that the average life of such equipment is three years. This is, of course, a simplification, as some items of equipment, particularly vehicles, are replaced almost annually, while certain scientific apparatus has a much longer life than three years. However, the life span of much apparatus, e.g.: recording equipment, is kept quite short by obsolescence, and three years seems to be an average life figure widely accepted in the industry.

Physical demand for new "Units" (a unit is defined here as including the entire equipment required by a crew) has been estimated from figures on peak crews operating each year and is shown in Table A5-4. Replacement demand is shown in Table A5-5.

Table A5-4

Demand for New Geophysical Units

Alberta, 1947-52

	Peak Units in Use	Annual Increase
1947	20	5
1948	60	40
1949	90	30
1950	100	10
1951	120	20
1952	133	13

Table A5-5

Replacement and Total Demand for Geophysical Units

Alberta, 1947-52

Replacement of Units Bought:	1947	1948	1949	1950	1951	1952
1944 and earlier	9	-	-	9	-	-
1945	-	4	-	-	4	-
1946	-	-	2	-	-	2
1947	-	-	-	5	-	-
1948	-	-	-	-	40	-
1949	-	-	-	-	-	30
Total Replacement Demand	9	4	2	14	44	32
Add New Units (Table A5-4)	5	40	30	10	20	15
Total Demand	14	44	32	24	64	47

Estimated capital expenditures on geophysical units were estimated on the basis of the following cost estimates. These relate to seismograph units in particular. However, although gravity units are cheaper, airborne magnetometer units are much more expensive, and it is felt that the use of the seismic cost estimates does not lead to much distortion, especially in view of the preponderance of this type of operation. Total estimated capital expenditures appear in Table A5-7.

Table A5-6

Estimated Cost of Geophysical Unit (Seismic)

Alberta, 1947-52

1947	60,000
1948	65,000
1949	75,000
1950	80,000
1951	85,000
1952	90,000

Table A5-7

Estimated Capital Expenditures, Geophysical Contractors

Alberta, 1947-52
(Thousands of Dollars)

Year	Units Purchased	Price Per Unit	Total Expenditures
1947	14	60	840
1948	44	65	2,860
1949	32	75	2,400
1950	24	80	1,920
1951	64	85	5,440
1952	47	90	4,230

(c) Allocation of Capital Expenditures to Sector Accounts

Principal items of equipment for a seismic unit and the sector from which each is purchased are listed below:

Sector III (Alberta)

Dealers' profit on Automotive Units, special truck bodies, trailers, camps, etc.

Sector IV (Rest of Canada)

Automotive Units, Cable.

Sector V (Rest of World)

Geophones, Recording Units, Amplifiers, Surveying Instruments, Shothole Drills.

This breakdown forms the basis of our cost distribution.

Allocation between sectors is based on the following percentages and is shown in Table A5-9.

Table A5-8

Percentage Allocation of Capital Expenditures by Geophysical Contractors - 1947-52

Sector	Percent
III	19.3
IV	36.2
V	44.5

Table A5-9

Allocation of Geophysical Capital Expenditures to Sector Accounts, 1947-52

(Thousands of Dollars)

Year	Total	Sector III	Sector IV	Sector V
1947	840	162	304	374
1948	2,860	552	1,035	1,273
1949	2,400	463	869	1,068
1950	1,920	370	695	855
1951	5,440	1,050	1,970	2,420
1952	4,230	816	1,530	1,884

(d) Sources of Funds

Net funds required, since expenses were covered by earnings, include only those portions of capital expenditures not covered by depreciation charges, plus changes in working capital.

Working capital estimates were prepared by estimating total requirements on a six weeks' expenditures basis. A first estimate of the increase was prepared on the basis of these estimated requirements. These were then adjusted to eliminate extreme year to year fluctuations. This method was used for calculating working capital requirements for all service company groups.

Capital requirements not met by depreciation are assumed to be equity investment and come apparently from two sources:

(1) Direct investment by U.S. firms.

(2) Investment by individuals resident in Canada, chiefly Albertans.

There are no Canadian public companies engaged in geophysical prospecting, and of the Canadian firms in this field nearly all are owned by Alberta residents.

Equity investment has been divided between these two groups on a basis to reconcile with the ownership data in Table A5-2. Depreciation accruals were divided on the basis of ownership at January 1, and additional requirements estimated to make investment reconcile with unit ownership. Table A5-10 shows the resulting estimates of cash sources for geophysical contracting firms.

Table A5-10

Sources of Funds, Geophysical Contractors (Sector II)

Alberta, 1947-52

(Thousands of Dollars)

Year	Capital Expenditures	Increase In Working Capital	Gross Requirements	Depreciation	Net Requirements	Sector III	Sector IV	Sector V
1947	840	100	940	348	592	-	-	592
1948	2,860	738	3,598	977	2,621	374	-	2,247
1949	2,400	925	3,325	2,235	1,090	264	-	826
1950	1,920	1,550	3,470	2,804	666	159	-	507
1951	5,440	680	6,120	4,080	2,040	252	-	1,798
1952	4,230	1,110	5,340	4,618	722	460	-	262

B. Drilling Contractors

(a) Income Account

Contract income has been broken down on the basis of the percentages shown in Table A5-11, resulting in the breakdown shown in Table A5-12. In Table A5-13, these cost breakdowns are allocated to sector accounts. Labour is allocated to Sector III as are Fuel, Repairs, Administration, etc. An arbitrary 10% - 20% - 70% split of Materials and Supplies between Sectors III, IV and V has been made. Income Tax has been split between Sector III and IV on the same basis as used in Table A3-15, above. Profits were allocated between Sector III and Sector V on the basis of ownership of rigs in use as indicated in Table A5-14.

Table A5-11

Analysis of Revenue and Expense, Drilling Contractors

Alberta, 1947-52

	Percentages					
	1947	1948	1949	1950	1951	1952
Revenue	100.0	100.0	100.0	100.0	100.0	100.0
Wages, Salaries and Employee Benefits	21.8	21.3	26.2	31.9	28.2	31.2
Materials and Supplies	19.2	18.3	24.2	29.5	26.4	28.3
Fuel	4.3	3.8	4.7	5.4	4.9	5.3
Repairs	6.7	5.9	7.4	8.5	7.5	8.1
Administration, Moving, etc.	7.1	6.4	7.9	9.0	8.0	8.1
Depreciation	6.2	5.8	7.7	9.3	8.3	9.0
Total Expense	65.3	61.5	78.1	93.6	83.3	90.0
Income Taxes	10.4	11.5	7.2	2.2	7.6	5.2
Profit after Tax	24.3	27.0	14.7	4.2	9.1	4.8
	100.0	100.0	100.0	100.0	100.0	100.0

Source: Estimated from data appearing in: Provincial Bureau of Statistics, op. cit. D. B. S. Contract Drilling in the Mining Industry, Annual Issues. Binning, R. L., and Corey, B. H., in Oil in Canada, 3 Nov. 1952, p. 60.

Table A5-12

Revenues and Expenses of Drilling Contractors

Alberta, 1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Revenue:	6,257	11,240	22,794	30,696	39,436	47,080
Labour	1,363	2,394	5,972	9,792	11,121	14,689
Materials and Supplies	1,202	2,057	5,516	9,055	10,411	13,324
Fuel	269	427	1,071	1,658	1,932	2,495
Repairs	419	663	1,687	2,609	2,958	3,813
Administration, Moving,etc.	444	719	1,801	2,763	3,155	3,813
Income Taxes	652	1,292	1,641	675	2,997	2,448
Profit after Tax	1,520	3,036	3,351	1,289	3,589	2,260
Total Cash Expense	5,869	10,588	21,039	27,841	36,163	42,842
Depreciation	388	652	1,755	2,855	3,273	4,238
Total Expense	6,257	11,240	22,794	30,696	39,436	47,080

Table A5-13

Allocation of Cash Expense of Drilling Contractors

Alberta, 1947-52

(Thousands of Dollars)

	Total	Sector III	Sector IV	Sector V
1947				
Labour	1,363	1,363	-	-
Materials and Supplies	1,202	120	240	842
Fuel	269	269	-	-
Repairs	419	419	-	-
Administration, etc.	444	444	-	-
Tax	652	3	649	-
Profit	1,520	912	-	608
Total 1947	5,869	3,530	889	1,450
1948				
Labour	2,394	2,394	-	-
Materials and Supplies	2,057	206	512	1,339
Fuel	427	427	-	-
Repairs	663	663	-	-
Administration, etc.	719	719	-	-
Tax	1,292	12	1,280	-
Profit	3,036	2,146	-	890
Total 1948	10,588	6,567	1,792	2,229
1949				
Labour	5,972	5,972	-	-
Materials and Supplies	5,516	552	1,104	3,860
Fuel	1,071	1,071	-	-
Repairs	1,687	1,687	-	-
Administration, etc.	1,801	1,801	-	-
Tax	1,641	18	1,623	-
Profit	3,351	2,366	-	985
Total 1949	21,039	13,467	2,727	4,845
1950				
Labour	9,792	9,792	-	-
Materials and Supplies	9,055	906	1,812	6,337
Fuel	1,658	1,658	-	-
Repairs	2,609	2,609	-	-
Administration, etc.	2,763	2,763	-	-
Tax	675	5	670	-
Profit	1,289	853	-	436
Total 1950	27,841	18,586	2,482	6,773
1951				
Labour	11,121	11,212	-	-
Materials and Supplies	10,411	1,041	2,082	7,288
Fuel	1,932	1,932	-	-
Repairs	2,958	2,958	-	-
Administration, etc.	3,155	3,155	-	-
Tax	2,997	20	2,977	-
Profit	3,589	2,391	-	1,198
Total 1951	36,163	22,618	5,059	8,486
1952				
Labour	14,689	14,689	-	-
Materials and Supplies	13,324	1,332	2,665	9,327
Fuel	2,495	2,495	-	-
Repairs	3,813	3,813	-	-
Administration, etc.	3,813	3,813	-	-
Tax	2,448	29	2,419	-
Profit	2,260	1,460	-	800
Total 1952	42,842	27,631	5,084	10,127

Table A5-14

Ownership of Drilling Rigs in Alberta, 1947-52

Year	Total	Canadian	Other	New Rigs Added
1947	50	30	20	30
1948	82	38	24	32
1949	85	60	25	3
1950	127	84	43	42
1951	183	122	61	46
1952	155	100	55	(28)

Source: Oil in Canada, September 15, 1952, P. B. S. Oil Industry Statistics 1946-53

(b) Capital Expenditures

In 1946, the Provincial Bureau of Statistics reported that there were 20 drilling rigs operating in Alberta. Nearly all of these were locally owned. The following year, the Leduc discovery caused an influx of rigs belonging to American contractors. While records available are sketchy, American rigs appear to have been about one-third of the total in the province for the period under review. 1952 costs of rigs then in use range from $75,000 to $400,000 and over. No accurate figures are available, but 1952 costs for the average drilling rig in Western Canada could not have been far from $150,000. The following is an estimate of cost of an average rig in the other years.

1947 - $104,000
1948 - $117,000
1949 - $125,000
1950 - $128,000
1951 - $141,000

Estimates of capital expenditures are highly conjectural, not only because of the inadequate estimates of unit costs but because of the constant flow of rigs across provincial and international borders. (This problem also exists in the case of seismic units, but they appear to have been more stationary.) Not all the increase in numbers of rigs in Alberta represent new rigs, and the decrease taking place in 1952 represents a movement of rigs out of the province. However, if we impute an investment for new rigs moved in and a disinvestment for rigs moved out, a fairly reasonable estimate of the actual

impact of drilling contractors' expenditures on the provincial economy is obtained.

Replacement expenditures on rigs are another question mark. During this period, demand grew so rapidly that it is fairly certain that no rigs were scrapped. Instead, they were repaired and kept running. There were no changes in technology as far reaching as those causing obsolescence of seismic equipment. Some capital outlays were necessitated to replace trucks, motors, mud tanks, and other equipment on rigs. These have been estimated at the equivalent of 10% of the stock of rigs in existence at the start of the year. Table A5-15 indicates estimated capital expenditures by drilling firms and their allocation. For purposes of allocation between sectors, it has been assumed that of the total spent, 10% accrued to Alberta supply companies etc., while the rest represented imports from the U.S. The 1952 disinvestment represents a movement of rigs into other provinces, and is indicated as a capital export.

Table A5-15

Capital Expenditures, Drilling Contractors

Alberta, 1947-52

	1947	1948	1949	1950	1951	1952
Rigs at Jan. 1st	20	50	82	85	127	183
Replacement of Equipment, Rig - Equivalents	2	5	8	9	13	18
New Rigs Added	30	32	3	42	46	(28)
Total	32	37	1	51	59	(10)
Unit Cost ($M)	104	117	125	128	141	150
Estimated Capital Expenditures, $M	3,328	4,329	1,375	6,528	8,319	2,700
Sector III	333	433	138	653	832	270
Sector IV	-	-	-	-	-	-
Sector V	2,995	3,896	1,237	5,875	7,487	2,430
Capital Export						
Sector IV	-	-	-	-	-	(4,200)

(c) Sources of Funds

Table A5-16 indicates the sources of funds raised by drilling contracting firms to meet their capital expenditures.

Funds provided by Sector III and V took, almost exclusively, the form of equity interests in private companies. Very few (less than 5) of the drilling contractors are publicly held companies, and the nature of the business does not lend itself to the extending of long term credit. Some considerable amount of short term installment credit was provided by supply companies to new entrants. The allocation between Sectors III and V is based on the estimated ownersip of rigs by American and Canadian companies.

Table A5-16

Sources of Funds, Drilling Contractors

Alberta, 1947-52

(Thousands of Dollars)

Year	Capital Expenditures	Increase In Working Capital	Gross Requirements	Depreciation	Net Requirement	Sector III	Sector IV	Sector V
1947	3,328	250	3,578	388	3,190	1,964	-	1,226
1948	4,329	787	5,116	652	4,464	2,911	-	1,553
1949	1,375	1,741	3,116	1,755	1,361	896	-	465
1950	6,529	1,134	7,662	2,855	4,797	3,130	-	1,677
1951	8,319	790	9,109	3,273	5,836	3,788	-	2,048
1952	2,700	1,713	4,413	4,238	175	120	-	55
1952 (Capital Movement*)	(4,200)	-	(4,200)	-	-	-	(4,200)	-

* This represents a movement of rigs from Alberta into other provinces and may be regarded as a disinvestment in Alberta. Instead of a source of funds Sector IV becomes a recipient. These negative figures are indicated by grackets ().

C. Structure Test Drilling

(a) Income Account

Income of core drilling contractors has been broken down on the same basis used for operators of full scale rigs and shown in Table A5-12. The resulting estimates of expense are shown in Table A5-17. Allocation to sectors is given in Table A5-18. Practically all structure test drilling was done by local firms.

Table A5-17

Income and Expenses, Structure Test Drilling Contractors 1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Revenues	72	492	972	2,532	4,524	4,560
Expense						
Labour	16	105	254	805	1,277	1,424
Materials and Supplies	14	90	235	745	1,193	1,290
Fuel	3	19	46	137	222	242
Repairs	5	29	72	215	339	370
Overhead, etc.	5	31	77	228	362	370
Depreciation	4	29	40	136	275	411
Total Expense	47	303	714	2,266	3,668	4,107
Income Taxes	7	56	88	96	384	237
Profit after Tax	18	133	160	170	472	216
Total	72	492	972	2,532	4,524	4,560

Table A5-18

Allocation of Cash Expenditures of Structure Test Drillers

Alberta, 1947-52

(Thousands of Dollars)

	Total	Sector III	Sector IV	Sector V
1947				
Labour, Fuel, Repairs and Administration	29	29	-	-
Materials and Supplies	14	1	3	10
Income Tax	7	-	7	-
Profit	18	18	-	-
	68	48	10	10
1948				
Labour, Fuel, Repairs and Administration	184	184	-	-
Materials and Supplies	90	9	18	63
Income Tax	56	-	56	-
Profit	133	133	-	-
	463	326	74	63
1949				
Labour, Fuel, Repairs and Administration	449	449	-	-
Materials and Supplies	235	24	47	164
Income Tax	88	-	88	-
Profit	160	160	-	-
	932	633	135	164
1950				
Labour, Fuel, Repairs and Administration	1,385	1,385	-	-
Materials and Supplies	745	75	149	521
Income Tax	96	-	96	-
Profit	170	170	-	-
	2,396	1,630	245	521
1951				
Labour, Fuel, Repairs and Administration	2,200	2,200	-	-
Materials and Supplies	1,193	119	239	835
Income Tax	384	3	381	-
Profit	472	472	-	-
	4,249	2,794	620	835
1952				
Labour, Fuel, Repairs and Administration	2,406	2,406	-	-
Materials and Supplies	1,290	129	258	903
Income Tax	237	2	235	-
Profit	216	216	-	-
	4,149	2,753	493	903

(b) Capital Account

No information is available about the number of core drilling rigs actually utilized for this activity. The rigs themselves are generally interchangeable with the rigs used for drilling shot holes for seismograph operations. Rigs used for that purpose have already been included in the estimates for geophysical companies. Table A5-19 shows the estimated number of rigs used for core drilling, based on 8 working months per year for each rig.

Table A5-19

Structure Test Drills Used for Core Drilling

Alberta 1947-52

Year	Total in Use(2)	New Drills Required
1947	1	-
1948	5	4
1949	10	5
1950	26	16
1951	47	21
1952	48	1

Table A5-20 shows estimated levels of unit costs, estimated capital expenditures and their allocation. The allocation assumes that the trucks on which the drills were mounted were made in Canada and the drills imported. Expenditures in Sector III represent margins of local distributors.

Table A5-20

Estimated Capital Expenditures, Structure Test Drilling Contractors

Alberta 1947-52

(Thousands of Dollars)

Year	Cost per Unit	Units	Total Cost	Sector III	Sector IV	Sector V
1947	10	-	-	-	-	-
1948	11	4	44	4	10	30
1949	12.5	5	73	8	16	49
1950	13	16	208	23	46	139
1951	14	21	298	33	66	199
1952	15	1	15	1	4	10

(2) Based on crew-months estimates, Table A2-15.

(c) Sources of Funds

Table A5-21 indicates sources of funds required by structure test drilling contractors. It is believed that all funds were equity investment by Alberta residents.

Table A5-21

Sources of Funds, Structure Test Drilling Contractors

Alberta, 1947-52

Year	Capital Expenditure	Increase in Working Capital	Gross Requirement	Depreciation	Sector III
1947	-	6	6	4	2
1948	44	50	94	29	65
1949	73	85	158	40	118
1950	208	220	428	136	292
1951	298	280	578	275	303
1952	15	40	55	411	(356)

It is worthy of note that subsequent to 1952, structure test drilling activity fell off rapidly as it proved relatively unsuccessful. Consequently the 1952 surplus of depreciation over requirements provided a means for the withdrawal of capital from this portion of the industry.

D. Well Servicing Companies, etc.

This group includes companies providing cementing, drillstem testing, diamond coring, directional drilling, well stimulation, fishing and similar services as well as the services of engineering and geological consultants.

(a) Income Account

Income has been broken down on the basis shown in Table A5-22. The resulting estimates are shown in Table A5-23, and allocated to sector accounts in Table A5-24.

The primary basis for the breakdown of expenditure (Table A5-22) is the data contained in the Provincial Bureau of Statistics' tabulation(3). Virtually none of the companies in this field in Canada are publicly held and any estimate of their earnings is subject to a fairly wide margin of error. It should be noted here that the concept of service expenditures as used in this study appears to be broader than that used in the Provincial Bureau's report. It is suspected that many of the respondents included service expenditures under drilling costs. As a result, totals as shown here are considerably higher.

Table A5-22

Analysis of Revenue and Expense, Well Servicing Contractors

Alberta, 1947-52

	%
Wages, Salaries and Employee Benefits	38
Materials and Supplies	20
Fuel and Electricity	5
Repairs	5
Administration and General Expense	8
Depreciation	5
Profit before Tax	19*
Total Income	100

* Tax rate varies.

(3) P.B.S. Op. Cit.

Table A5-23

Revenue and Expense of Well Servicing Contractors

Alberta, 1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Wages, etc.	1,480	2,636	5,307	7,159	9,475	11,409
Materials and Supplies	779	1,387	2,793	3,768	4,986	6,004
Fuel and Electricity	195	347	698	942	1,247	1,501
Repairs	195	347	698	942	1,247	1,501
Administration and General	312	555	1,117	1,507	1,995	2,402
Income Tax	221	394	976	1,253	2,155	2,970
Profit after Tax	518	923	1,778	2,327	2,591	2,736
Total Cash Expense	3,700	6,589	13,267	17,898	23,686	28,523
Depreciation	195	347	698	942	1,247	1,501
Total Revenue =Total Expense	3,895	6,936	13,965	18,840	24,933	30,024

Table A5-24

Allocation of Well Servicing Expense by Sectors

Alberta, 1947-52

(Thousands of Dollars)

	Total	Sector III	Sector IV	Sector V
1947				
Wages and Salaries	1,480	1,480	-	-
Materials and Supplies	779	390	156	233
Fuel and Electricity	195	195	-	-
Repairs	195	100	50	45
Administration and General	312	312	-	-
Income Tax	221	2	219	-
Profit after Tax	518	207	-	311
Total	3,700	2,686	425	589
1948				
Wages and Salaries	2,636	2,636	-	-
Materials and Supplies	1,387	693	277	417
Fuel and Electricity	347	347	-	-
Repairs	347	180	90	77
Administration and General	555	555	-	-
Income Tax	394	4	390	-
Profit after Tax	923	369	-	554
Total	6,589	4,784	757	1,048
1949				
Wages and Salaries	5,307	5,307	-	-
Materials and Supplies	2,793	1,400	557	836
Fuel and Electricity	698	698	-	-
Repairs	698	380	180	138
Administration and General	1,117	1,117	-	-
Income Tax	876	9	867	-
Profit after Tax	1,778	7,711	-	1,067
Total	13,367	9,622	1,604	2,041

Table A5-24 (Continued)

	Total	Sector III	Sector IV	Sector V
1950				
Wages and Salaries	7,159	7,159	-	-
Materials and Supplies	3,768	1,880	755	1,133
Fuel and Electricity	942	942	-	-
Repairs	942	500	240	202
Administration and General	1,507	1,507	-	-
Income Tax	1,253	10	1,243	-
Profit after Tax	2,327	931	-	1,396
Total	17,898	12,929	2,238	2,731
1951				
Wages and Salaries	9,475	9,475	-	-
Materials and Supplies	4,986	2,500	995	1,491
Fuel and Electricity	1,247	1,247	-	-
Repairs	1,247	650	350	247
Administration and General	1,995	1,995	2,140	-
Income Tax	2,155	15	2,140	-
Profit after Tax	2,581	1,032	-	1,549
Total	23,686	16,914	3,485	3,287
1952				
Wages and Salaries	11,409	11,409	-	-
Materials and Supplies	6,004	3,002	1,200	1,802
Fuel and Electricity	1,501	1,501	-	-
Repairs	1,501	800	390	311
Administration and General	2,402	2,402	-	-
Income Tax	2,970	36	2,934	-
Profit after Tax	2,736	1,094	-	1,642
Total	28,523	20,244	4,524	3,755

(c) Capital Account

Capital expenditures of firms in this class have been estimated as follows, on the basis of depreciation accruals.

Table A5-25

Capital Expenditures, Well Servicing Firms

Alberta, 1947-52

(Thousands of Dollars)

1947	300
1948	1,010
1949	2,240
1950	1,750
1951	2,000
1952	1,700

Table A5-26

Allocation of Capital Expenditures, Well Servicing Firms

Alberta, 1947-52

(Thousands of Dollars)

Year	Total	Sector III (10%)	Sector IV (30%)	Sector V (60%)
1947	300	30	90	180
1948	1,010	101	303	606
1949	2,240	224	672	1,344
1950	1,750	175	525	1,050
1951	2,000	200	600	1,200
1952	1,700	170	510	1,020

Sources of funds utilized by this group were as follows. For this exposition 100% dividend payout and subsequent re-investment is assumed.

Allocation of profits and source of funds were made on the basis of what data was available in trade publications concerning ownership of various companies. It appears that during the period in question all cementing and logging services, and all directional drilling was done by American firms while most other services were provided by local companies. A 60-40 split between the former and the latter has been assumed. There appears to have been no firms in this category owned in other parts of Canada. An allowance for working capital has been made, based on the level of expenditures.

E. Oilfield Construction Contractors

In addition to the specialized services we have been discussing, oilfield development requires the construction of field offices, garages, roads, tank footings, bridges, culverts and other items of a general construction nature. Usually this work is done by general contractors, though, of course,

Table A5-27

Sources of Funds, Well Servicing Firms

Alberta, 1947-52

(Thousands of Dollars)

Year	Capital Expenditures	Increase In Working Capital	Gross Requirement	Depreciation	Net Requirement	Sector III	Sector IV	Sector V
1947	300	300	600	195	405	162	-	243
1948	1,010	482	1,492	347	1,145	458	-	687
1949	2,240	730	2,970	698	2,272	909	-	1,363
1950	1,750	1,155	2,905	942	1,963	785	-	1,178
1951	2,000	965	2,965	1,247	1,718	687	-	1,031
1952	1,700	806	2,506	1,501	1,005	402	-	603

some general contractors specialize in oilfield work. Table A5-28 indicates the breakdown of expenditures by these firms used in preparing the estimates which follow:

Table A5-28

Content of Oilfield Construction Firms' Expenditures[4]

Labour	31%
Materials, Supplies and Fuel	51%
Overhead	5%
Income Tax	4%
Profit	5%
Depreciation	4%
	100%

Table A5-29

Revenue and Expenditures of Oilfield Construction Firms

Alberta, 1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Wages and Salaries	222	370	1,333	1,512	1,383	1,705
Materials, etc.	365	609	2,193	2,488	2,275	2,805
Administration	36	60	215	244	223	275
Income Tax	29	48	172	195	178	220
Profit	36	60	215	244	223	275
Total Cash Expense	688	1,147	4,128	4,683	4,282	5,280
Depreciation	27	48	172	196	178	220
Total Revenues = Total Expense	715	1,195	4,300	4,879	4,460	5,500

Table A5-30 indicates the breakdown, by sectors of construction expenditures. The only major item requiring allocation is materials, supplies, fuel etc. Availability of local materials depends of course on the nature of materials used for the activity in question. Fuel, sand, gravel, cement, brick and some lumber was available locally. All structural steel, on the other hand, was imported while plumbing and electrical fixtures, furnaces, culverts, etc. were brought in from other parts of Canada. No accurate information is available

(4) Labour and materials based on 1951-54 actual data from D. B. S., Construction in Canada, 1952-54, Ottawa, 1954, Table 5. Others estimated.

about the product-mix used by this sector of the construction industry. However, estimates of 40, 50 and 10 percent respectively for Sectors III, IV and V do not appear to be far out of line.

Table A5-30

Allocation of Expenditures, Oilfield Construction Firms

Alberta, 1947-52

(Thousands of Dollars)

	Total	Sector III	Sector IV	Sector V
1947				
Wages and Salaries	222	222	-	-
Materials, etc.	365	146	183	36
Administration	36	36	-	-
Income Tax	29	-	29	-
Profit	36	36	-	-
Total	688	440	212	36
1948				
Wages and Salaries	370	370	-	-
Materials, etc.	609	244	305	60
Administration	60	60	-	-
Income Tax	48	-	48	-
Profit	60	60	-	-
Total	1,147	734	353	60
1949				
Wages and Salaries	1,333	1,333	-	-
Materials, etc.	2,193	877	1,096	220
Administration	215	215	-	-
Income Tax	172	2	170	-
Profit	215	215	-	-
Total	4,128	2,642	1,266	220
1950				
Wages and Salaries	1,512	1,512	-	-
Materials, etc.	2,488	995	1,244	249
Administration	244	244	-	-
Income Tax	195	2	193	-
Profit	244	244	-	-
Total	4,683	2,997	1,437	249
1951				
Wages and Salaries	1,383	1,383	-	-
Materials, etc.	2,275	910	1,138	227
Administration	223	223	-	-
Income Tax	178	1	177	-
Profit	223	223	-	-
Total	4,282	2,740	1,315	227
1952				
Wages and Salaries	1,705	1,705	-	-
Materials, etc.	2,805	1,122	1,403	280
Administration	275	275	-	-
Income Tax	220	3	217	-
Profit	275	275	-	-
Total	5,280	3,380	1,620	280

Since these firms constitute a small fraction of the Province's general contracting industry, it is impossible to estimate their capital expenditures with any degree of reliability. It has been assumed instead that capital expenditures equal depreciation accruals for this group, and that capital expenditures were equally divided between other parts of Canada and the U.S. The resulting allocation of capital expenditures is shown in Table A5-31. The assumption that capital expenditures equal depreciation eliminates the necessity of considering outside sources of funds.

Table A5-31

Estimated Capital Expenditures, Oilfield Construction Firms

Alberta, 1947-52

(Thousands of Dollars)

Year	Sector IV	Sector V
1947	14	13
1948	24	24
1949	86	86
1950	98	98
1951	89	89
1952	110	110

F. Office Rentals

No information directly bearing on the amount of office rentals paid by the oil industry is available. These estimates must therefore be regarded with a great deal of caution. They are based on the D.B.S. report "Construction in Canada", and on business tax assessment for the City of Calgary [5], which gives a fairly good index of total rentals paid for commercial property in Calgary (including imputed rentals for owner occupied property). The resulting estimates were checked with estimates of rental derived

(5) City Clerk, Municipal Manual, Calgary, 1957, p. 74.

from the estimated number of administrative employees, making an allowance for space occupied per employee. The comparison indicates that the rental estimates lie in a reasonable range.

(a) Income Account

Table A5-32 indicates the estimated allocation of rental income received by office building owners.

Table A5-32

Revenue and Expenses of Office Building Owners

Alberta, 1947-52

(Thousands of Dollars)

	1947	1948	1949	1950	1951	1952
Revenue	400	600	900	1,200	1,600	2,000
Expense						
Maintenance, Property Taxes, etc.	140	210	315	420	560	700
Interest	80	120	180	240	320	400
Income Tax	36	54	90	126	221	312
Profit	84	126	180	234	259	288
Total Cash	340	510	765	1,020	1,360	1,700
Depreciation	60	90	135	180	240	300
Total Expense	400	600	900	1,200	1,600	2,000

Allocation of these expenditures between sectors, as shown in Table A5-33, has been made on the following assumptions:

(a) Maintenance, property taxes, etc. are paid to recipients within the province (Sector III).

(b) Interest is paid to Canadian firms not resident in Alberta such as life insurance companies, pension funds, trust companies, etc. (Sector IV).

(c) Income tax is paid to Alberta and the federal government (Sectors III and IV) on the basis indicated earlier in Table A3-14.

(d) Profits accrue 60% to residents and 40% to non-residents and are paid out as they accrue. The 60% seems high but the total includes owner-occupied buildings.

Table A5-33

Allocation of Expenditures, Income Account, Office Building Owners

Alberta, 1947-52

(Thousands of Dollars)

	Expenditures	Receipts		
	Sector II	Sector III	Sector IV	Sector V
1947				
Maintenance, Taxes, etc.	140	140	-	-
Interest	80	-	80	-
Income Tax	36	-	36	-
Profits	84	50	34	-
Total	340	190	150	-
1948				
Maintenance, Taxes, etc.	210	210	-	-
Interest	120	-	120	-
Income Tax	54	1	53	-
Profit	126	76	50	-
Total	510	287	223	-
1949				
Maintenance, Taxes, etc.	315	315	-	-
Interest	180	-	180	-
Income Tax	90	1	89	-
Profit	180	108	72	-
Total	765	424	341	-
1950				
Maintenance, Taxes, etc.	420	420	-	-
Interest	240	-	240	-
Income Tax	126	1	125	-
Profit	234	140	94	-
Total	1,020	561	459	-
1951				
Maintenance, Taxes, etc.	560	560	-	-
Interest	320	-	320	-
Income Tax	221	1	220	-
Profit	259	155	104	-
Total	1,360	716	644	-
1952				
Maintenance, Taxes, etc.	700	700	-	-
Interest	400	-	400	-
Income Tax	312	4	308	-
Profit	288	173	115	-
Total	1,700	877	823	-

(b) Capital Expenditures

Estimated cost of new office buildings constructed by or for oil companies in Alberta is as follows (Thousands of Dollars). These estimates are based on the estimated rental value of the properties.

1947	Nil
1948	1,000
1949	1,500
1950	1,500
1951	2,000
1952	2,000

Estimated allocation of these expenditures on the basis outlined in Table A5-34 is given in Table A5-35.

Table A5-34

Basis of Allocation, Building Costs(6)

Alberta, 1947-52

	Percentages			
	Sector II	Sector III	Sector IV	Sector V
Labour	33	33	-	-
Materials	45	12	25	8
Other	22	15	7	-
	100	60	32	8

Table A5-35

Allocation of Capital Expenditures, Office Buildings

Alberta, 1947-52

(Thousands of Dollars)

	Expenditures	Receipts		
	Sector II	Sector III	Sector IV	Sector V
1947	-	-	-	-
1948	1,000	600	320	80
1949	1,500	900	480	120
1950	1,500	900	480	120
1951	2,000	1,200	640	160
1952	2,000	1,200	640	160

(6) Based on D. B. S., Construction in Canada 1955-57, Ottawa 1957, p. 11.

(c) Sources of Funds

Net capital requirements, equal to capital expenditures less depreciation accurals which are assumed to be applied to amortization of existing debt, came from mortgages on the properties in question and from the owners' equity investment. No details are available on the extent of mortgage financing. However, nearly all appears to have come from financial institutions outside the province, an unknown portion of whose funds derived from Albertans' savings, while much of the equity financing came from residents. It is estimated that in total 70% of the required funds came from Sector IV, the balance from Sector III.

Table A5-36

Sources of Funds - Office Building Construction

Alberta, 1947-52

	Expenditures	Less Depreciation	Requirements	Sector III	Sector IV	Sector V
1947	-	60	(60)	(18)	(42)	-
1948	1,000	90	910	273	637	-
1949	1,500	135	1,365	410	955	-
1950	1,500	180	1,320	396	924	-
1951	2,000	240	1,760	528	1,232	-
1952	2,000	300	1,700	510	1,190	-

BIBLIOGRAPHY

(a) Government Publications

(1) City Clerk, Municipal Manual, Calgary, 1957.

(2) Department of National Revenue, Taxation Statistics, Annual Volumes 1949-1954 inclusive, Ottawa 1950-1955.

(3) Department of Mines and Minerals, Alberta Oil Picture 1947-54 Edmonton, 1955.

(4) Dominion Bureau of Statistics, Canada Year Book, volumes for 1948-49, 1950, 1951, 1952-53 and 1954, Ottawa 1950-1955.

(5) Dominion Bureau of Statistics, Canada's Balance of International Payments 1926-1948, Ottawa 1949, ibid 1946-55, Ottawa 1956.

(6) Dominion Bureau of Statistics, Construction in Canada, 1952-54, Ottawa 1954; ibid 1955-57, Ottawa 1957.

(7) Dominion Bureau of Statistics, Contract Drilling in the Mining Industry, Annual Volumes 1946-1952, Ottawa 1948-1954.

(8) Dominion Bureau of Statistics, Crude Petroleum Industry, Annual Volumes 1947, 1948, Ottawa 1949, 1950.

(9) Dominion Bureau of Statistics, Crude Petroleum and Natural Gas Industry, Annual Volumes 1949-1952, Ottawa 1951-1954.

(10) Dominion Bureau of Statistics, International Distribution of Ownership of the Petroleum Industry in Canada, Reference Paper 37, Ottawa 1952.

(11) Dominion Bureau of Statistics, National Accounts, Income and Expenditure 1926-1950, Ottawa 1952; ibid 1950-56, Ottawa 1957.

(12) Petroleum and Natural Gas Conservation Board, Alberta Oil and Gas Industry, Annual volumes 1947-1952, Calgary, 1948-1953.

(13) Provincial Bureau of Statistics, Employment Statistics and Expenditures of Firms Engaged in the Development of Alberta's Oil and Gas Resources 1951, 1952, Edmonton 1954, ibid 1953, Edmonton 1955, ibid 1954, Edmonton 1956.

(14) Provincial Treasurer, Public Accounts, Annual for Fiscal Years ending March 31, 1948 to 1953, Edmonton, 1948-1953.

(b) Statutes

(1) The Bank Act, Statutes of Canada, 1954 (2-3 Elizabeth II) Chapter 48

(c) Books and Pamphlets

(1) American Petroleum Institute, Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas, December 31, 1952, New York 1953.

(2) Blaw Knox Co., Exhibit 23, submission to Petroleum and Natural Gas Conservation Board on behalf of Leduc Southern Gas Absorption Ltd., Calgary, January 1953.

(3) Canadian Petroleum Association, Statistical Bulletin, Fall 1953.

(4) Canadian Petroleum Association, Submission to the Royal Commission on Energy, Calgary, Feb. 7, 1958.

(5) Financial Post (The), Survey of Oils, Annual Volumes, Toronto, 1947-1955, inclusive.

(6) Guthmann, H. G. and Dougall, H. E., Corporate Financial Policy, New York, 1948.

(7) Imperial Oil Limited, Facts and Figures about Canadian Oil, Toronto, 1955.

(8) Nickle, C. O., and Smith, A. R., Canadian Oil and Gas Directory, Calgary 1953.

(9) Paine, Paul, Oil Property Valuation, New York 1942.

(10) Royal Bank of Canada, Industry Statistics, Bulletin 17, Calgary, 1953.

(11) Shell Oil Company of Canada Limited, The Canadian Petrochemical Industry, Toronto, 1956.

(12) Uren, L. C., Petroleum Production Engineering, Vol. 3, Economics, New York, 1950.

(d) Corporate Reports, etc.

(1) Canadian Pacific Railway, Annual Reports, 1947-1952.

(2) Canadian National Railways, Annual Reports, 1947-1952.

(3) Hudson's Bay Company, Annual Reports, 1947-1952.

(4) Imperial Oil Limited, Annual Reports, 1947-1952.

(5) Imperial Oil Limited, Prospectus, November 16, 1951.

(e) Articles

(1) Anon., "Seismic crew at work", Oil in Canada, June 27, 1953.

(2) Binning, R. L. and Corey, B. H., "Changing trends in drilling costs", Oil in Canada, 3 November, 1952, p. 68.

(e) Articles (Continued)

(3) Dingle, W. B., "Significant developments in the Canadian oil and gas industry" C. I. M. M. Bulletin, June 1952, p. 340.

(4) Goodman, A. J., "Developments in Western Canada in 1951", A. A. P. G. Bulletin, June 1952, p. 1260.

(5) Handley, E. J., "Seismograph surveying in Central Alberta" World Oil, June 1948, p. 216.

(6) Joseph, J., "20 days in and 10 days out", World Oil, September 1952 p. 290.

(7) Kastrop, J. E., "Geophysical costs outrun prices", World Oil, May 1951, p. 55.

(8) Lahee, F. H., "Exploratory drilling in 1952", A. A. P. G. Bulletin June 1953 (earlier years also, in June issues).

(9) O'Malley, T. M., "Alberta flying magnetometer survey completed" World Oil, May 1951, p. 235.

(10) Somerville, H. H., "Alberta's mineral resources", Oil in Canada, March 2, 1953, p. 22.

(11) Struth, H. J., "Efficient practices reduced 1954 exploration costs", World Petroleum, March 1955, p. 61.

(12) Struth, H. J., "Rising costs justify higher crude prices", World Petroleum, December 1955, p. 62.

(13) Weeks, L. G., "Developments in foreign fields", A. A. P. G. Bulletin, June 1948, p. 1100, June 1959, p. 1040.

(f) News Items

(1) Canadian Oil and Gas Industries, Gardenvale, October 1952, p. 31.

(2) Daily Oil Bulletin, Calgary, June 15, 1956.

(3) Financial Post, Toronto, December 4, 1954.

(4) Oil in Canada, Winnipeg, October 20, 1952, November 3, 1952, November 17, 1952, July 27, 1953.

(5) World Oil, Houston, February 1952, p. 236.

(6) World Petroleum, New York, May 1952, p. 75.